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Ito et al.

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(54) **ENDOSCOPE WITH BUILT-IN FILTERING MEANS**

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A61B 10/00 (2006.01)
A61M 1/00 (2006.01)

(52) **U.S. Cl.** **600/159**; 600/154; 600/158; 600/565; 604/319

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See application file for complete search history.

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(57) **ABSTRACT**

The rear end side of treatment equipment-side duct which enables treatment equipment provided within an insertion unit to be inserted, and which also serves as a suction duct, is disposed generally in parallel with the tip side of a suction-side duct extending forward from a universal cable side so as to be an opening end, and both opening ends are detachably attached with a filter unit in which a forceps plug portion serving as a suction duct opening, and a filter portion for retrieving (storing) tissue by suction are provided, and a suction switchover valve for performing a suction switchover operation is provided at the backward side thereof, thereby enabling retrieval of tissue without influence of the periphery of the suction switchover valve. Thus, defects due to a long duct can be eliminated, and tissue can be retrieved without influence of the periphery of the suction switchover valve.

10 Claims, 13 Drawing Sheets

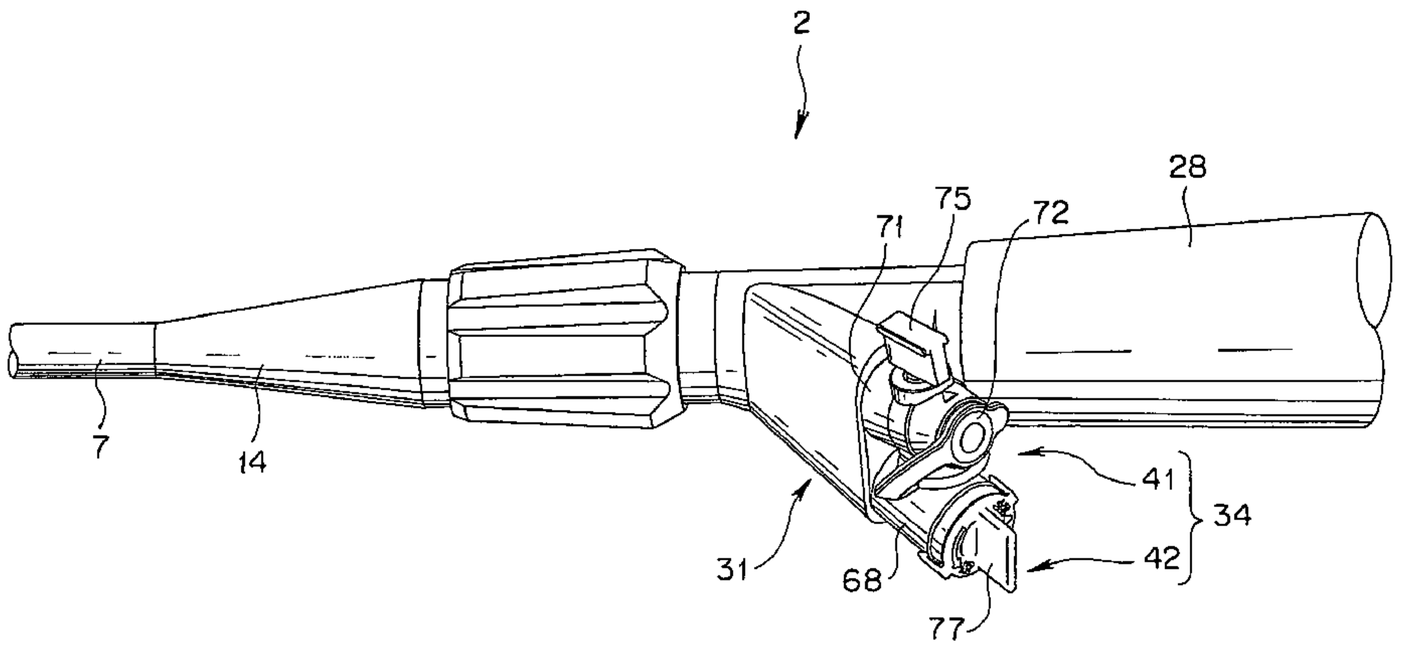

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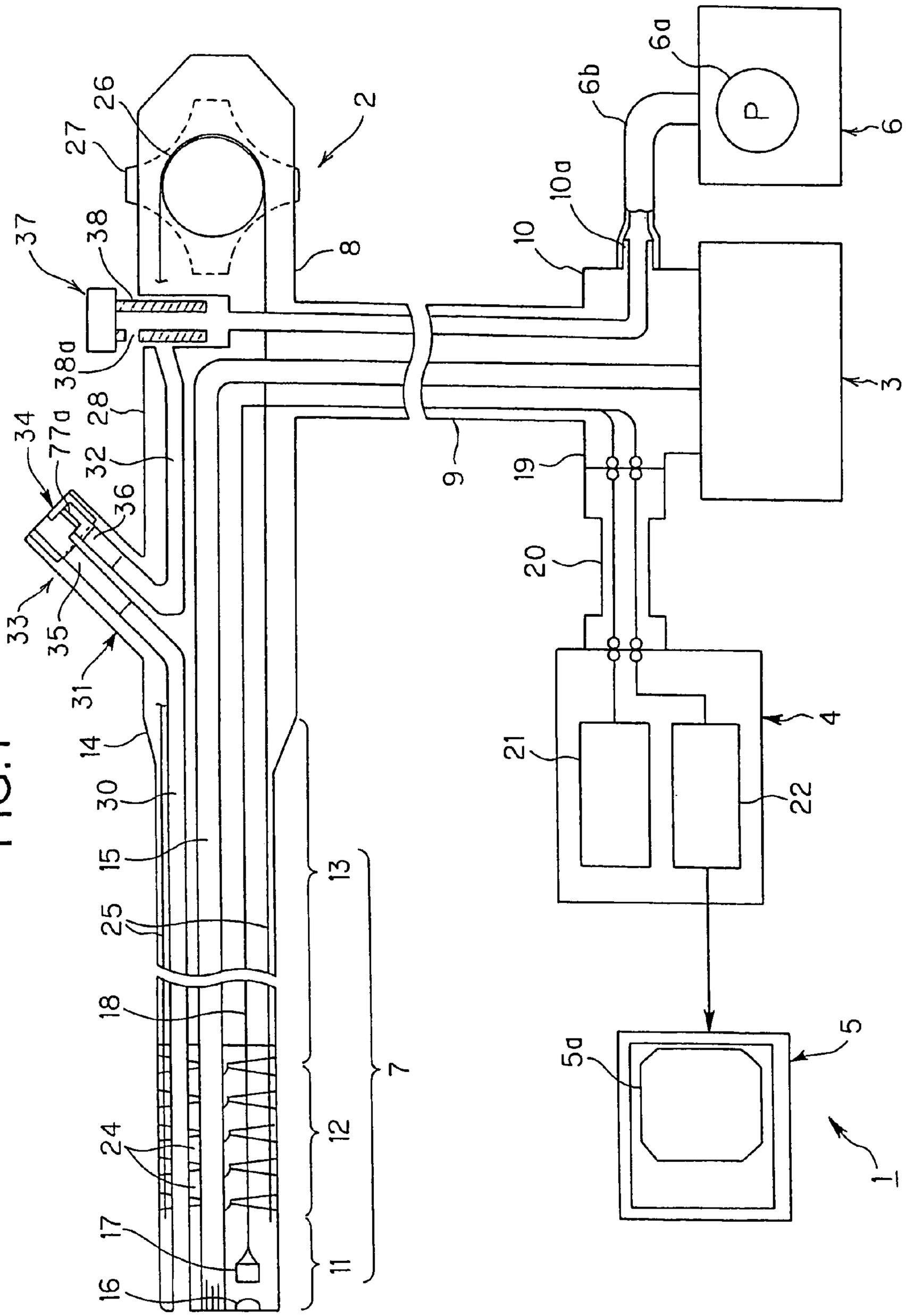
FIG.1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2
3
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38
38a
77a
P

FIG.2

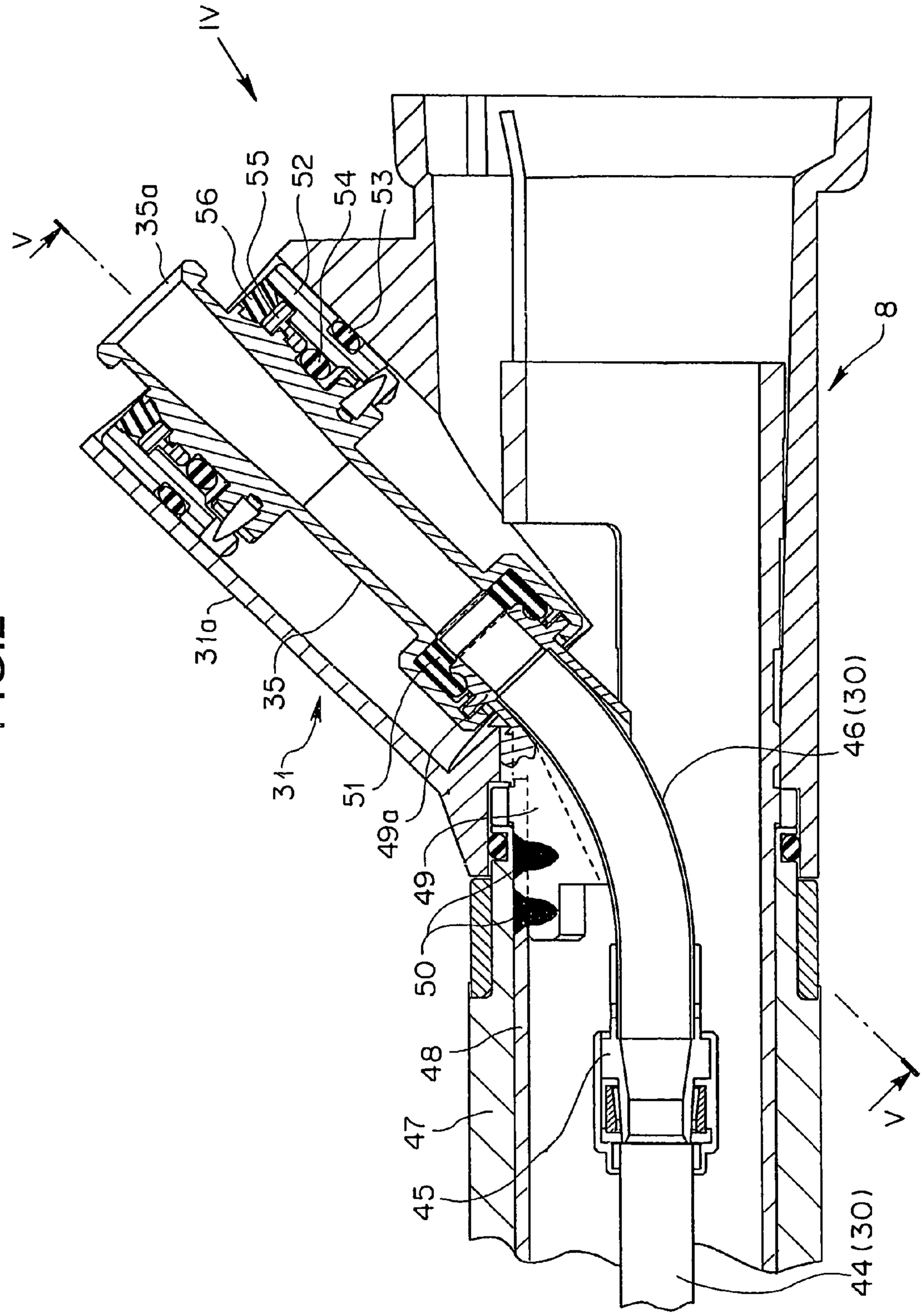
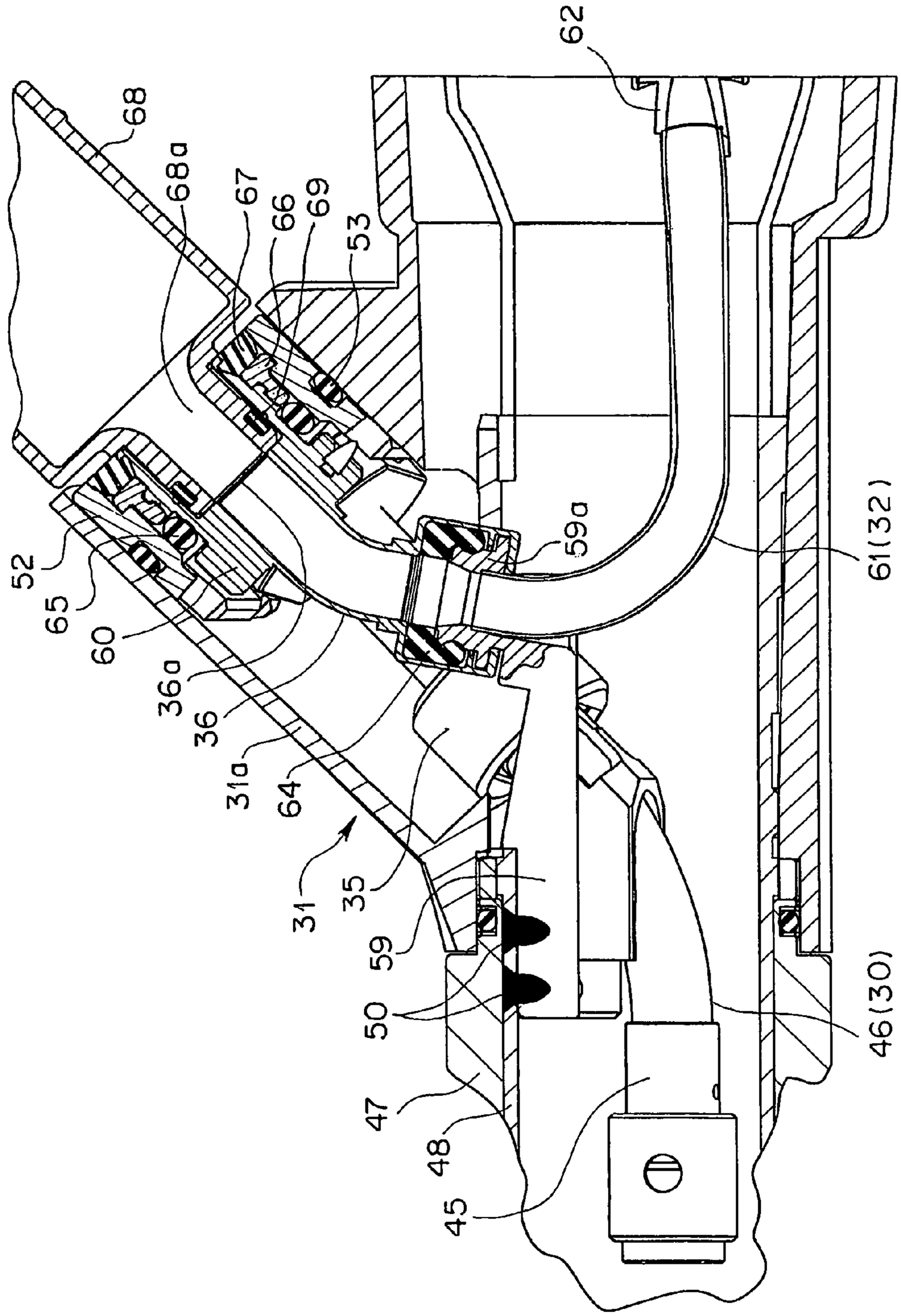


FIG.3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66
69
53
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50
47
48
45
59a
61(32)
46(30)

FIG.4

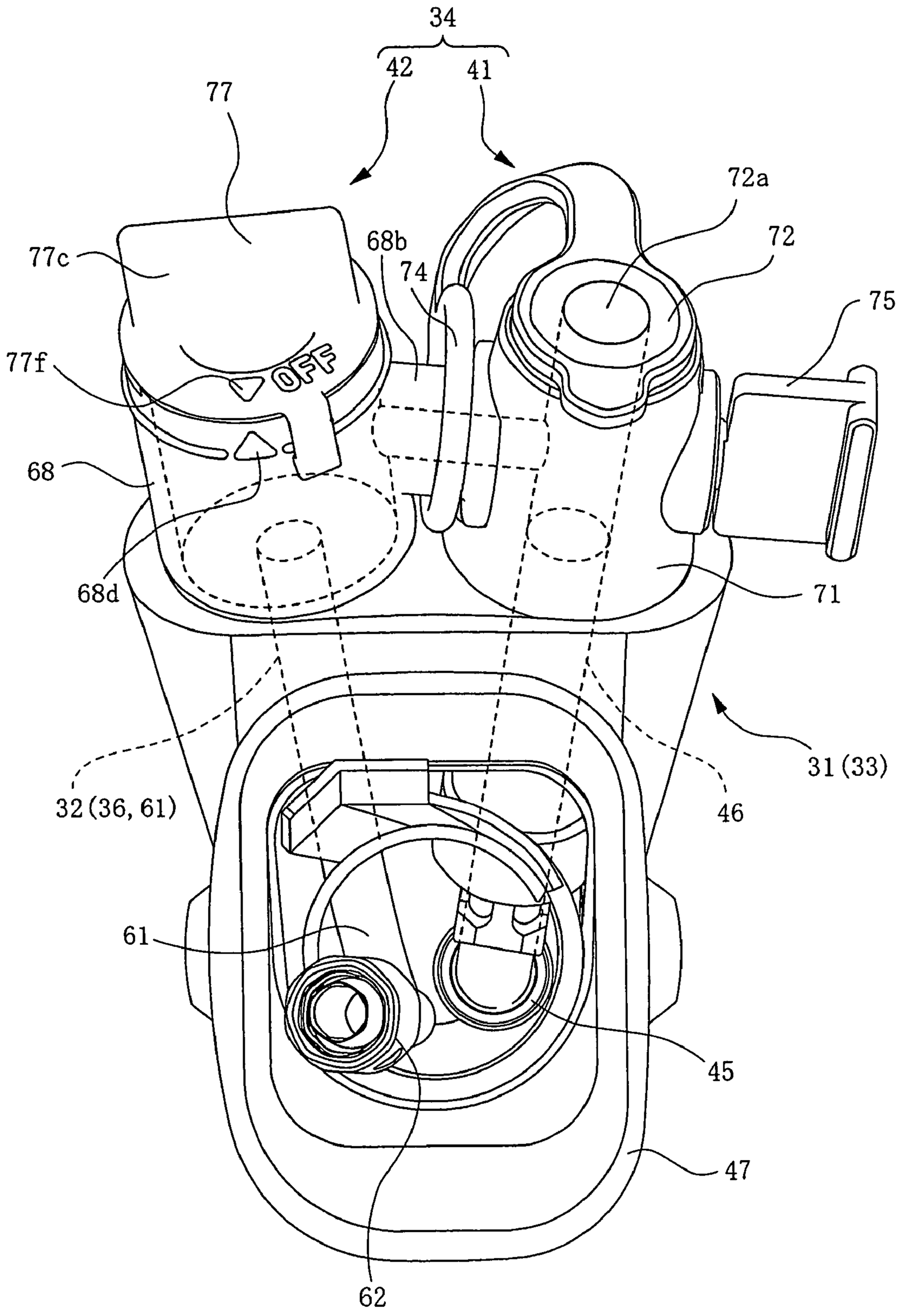
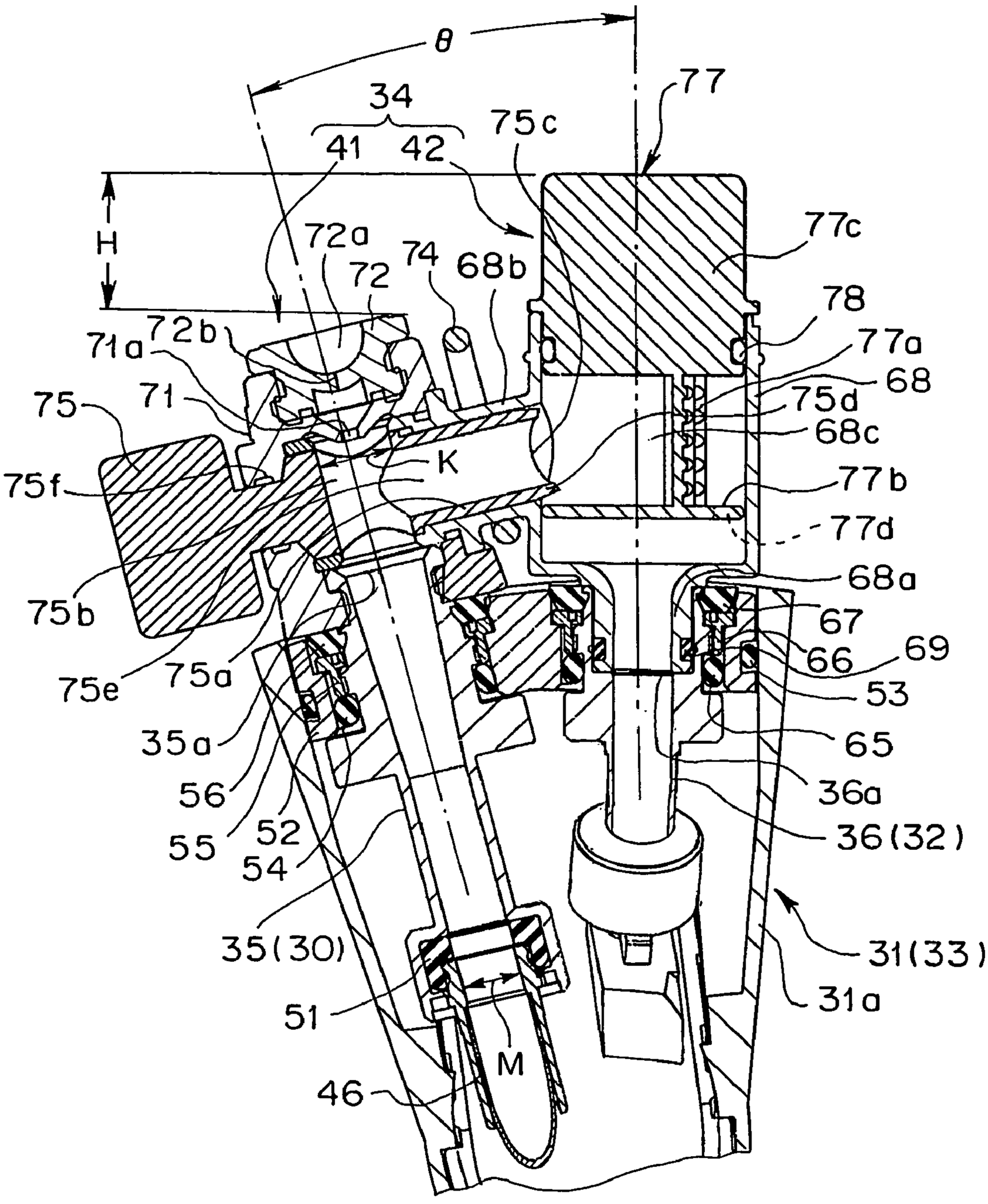

34
42
41
77
72a
68b
72
77c
74
75
77f
OFF
68
68d
71
31 (33)
32 (36, 61)
46
61
45
47
62

FIG.5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75c
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77c
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77a
68
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75d
68c
K
75f
77b
77d
68a
75b
67
66
69
75e
75a
53
35a
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54
35(30)
31(33)
51
31a
M
46

FIG.6

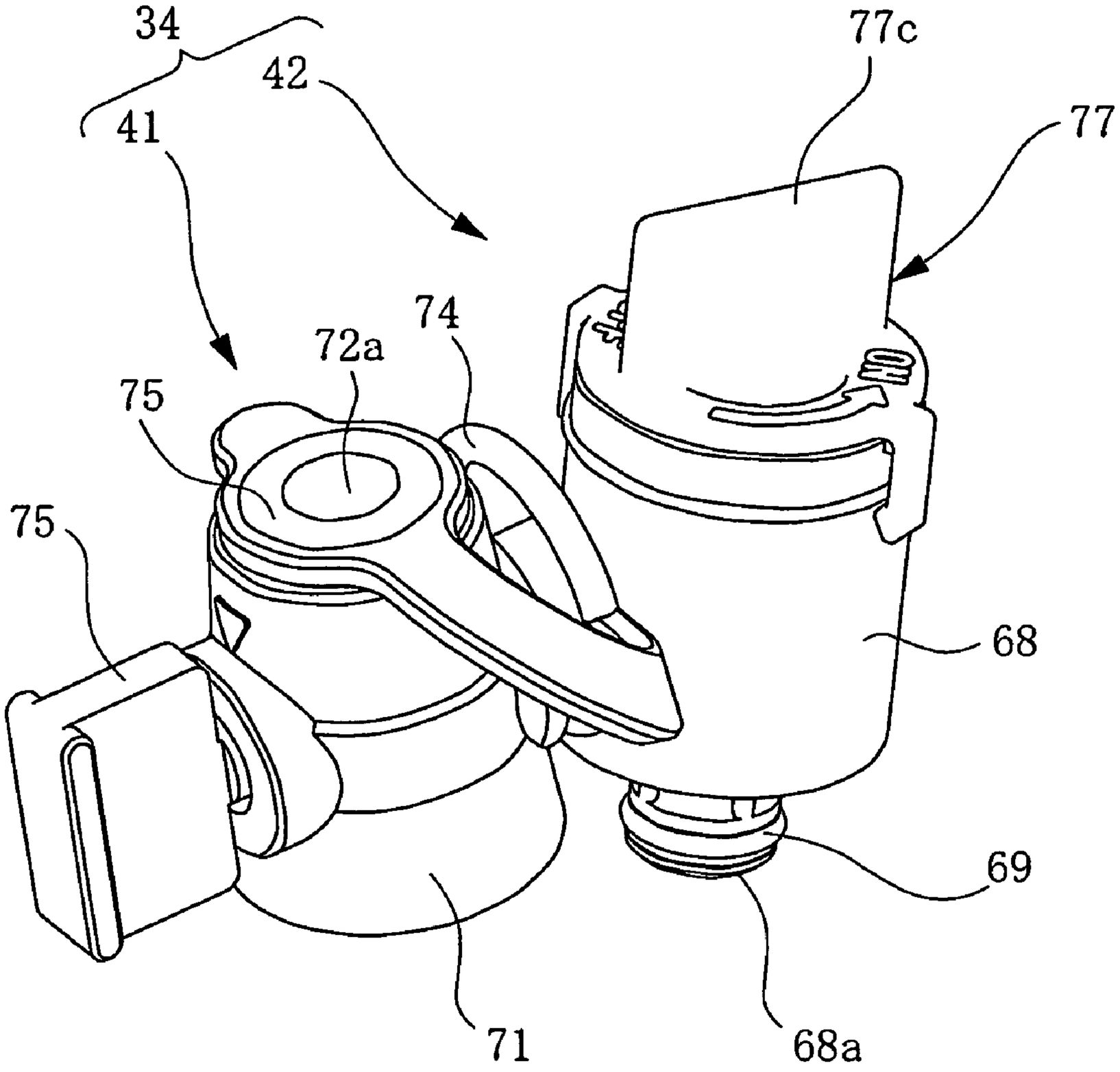


FIG.7

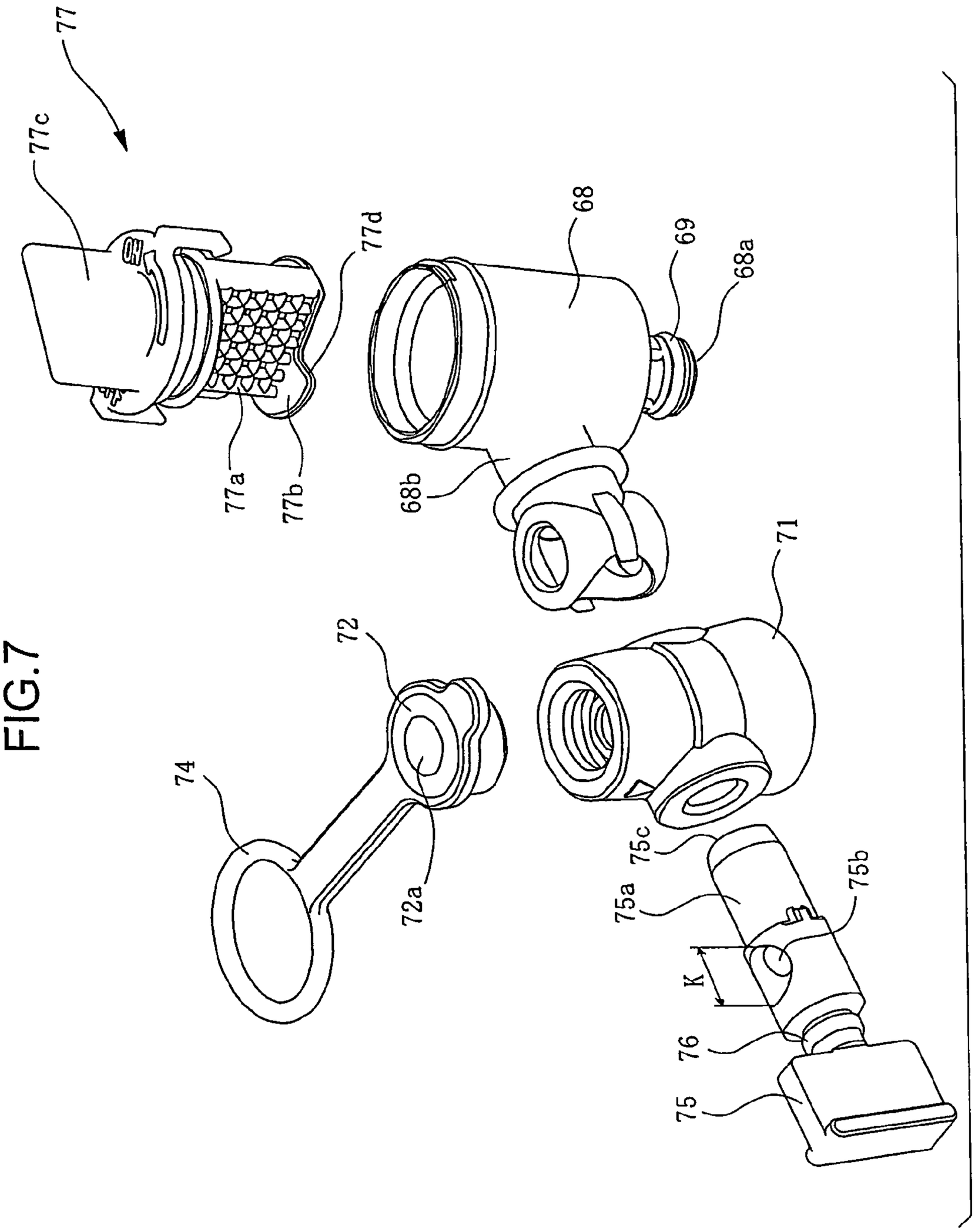


FIG.8

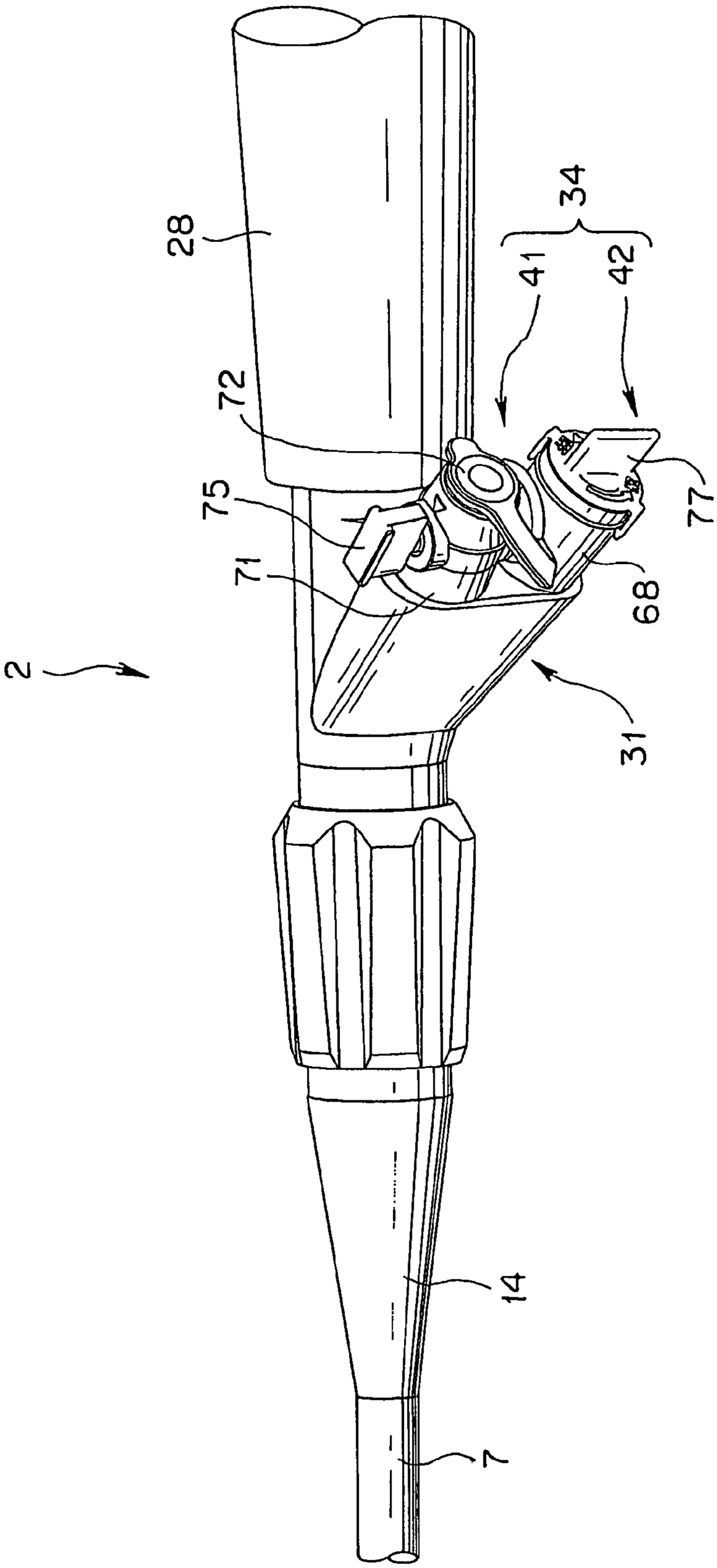


FIG.9

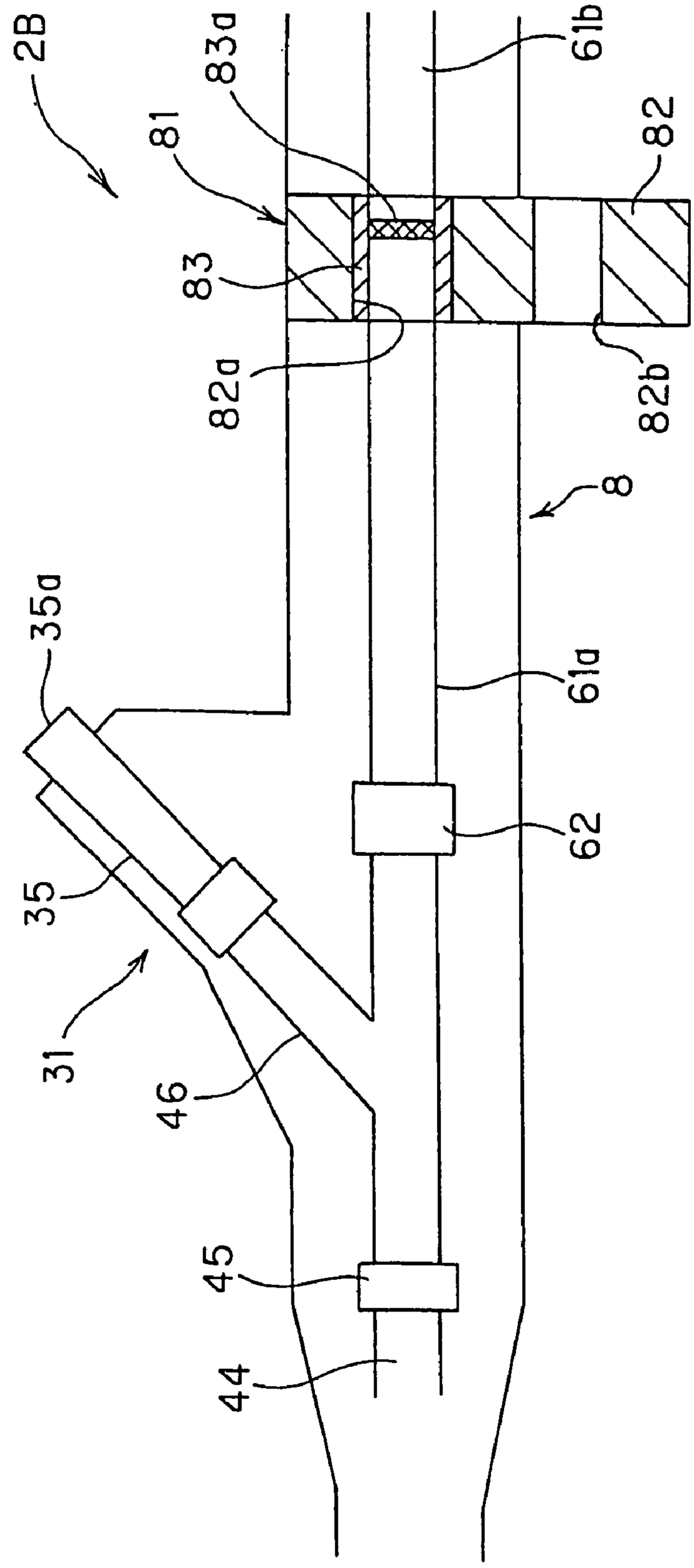
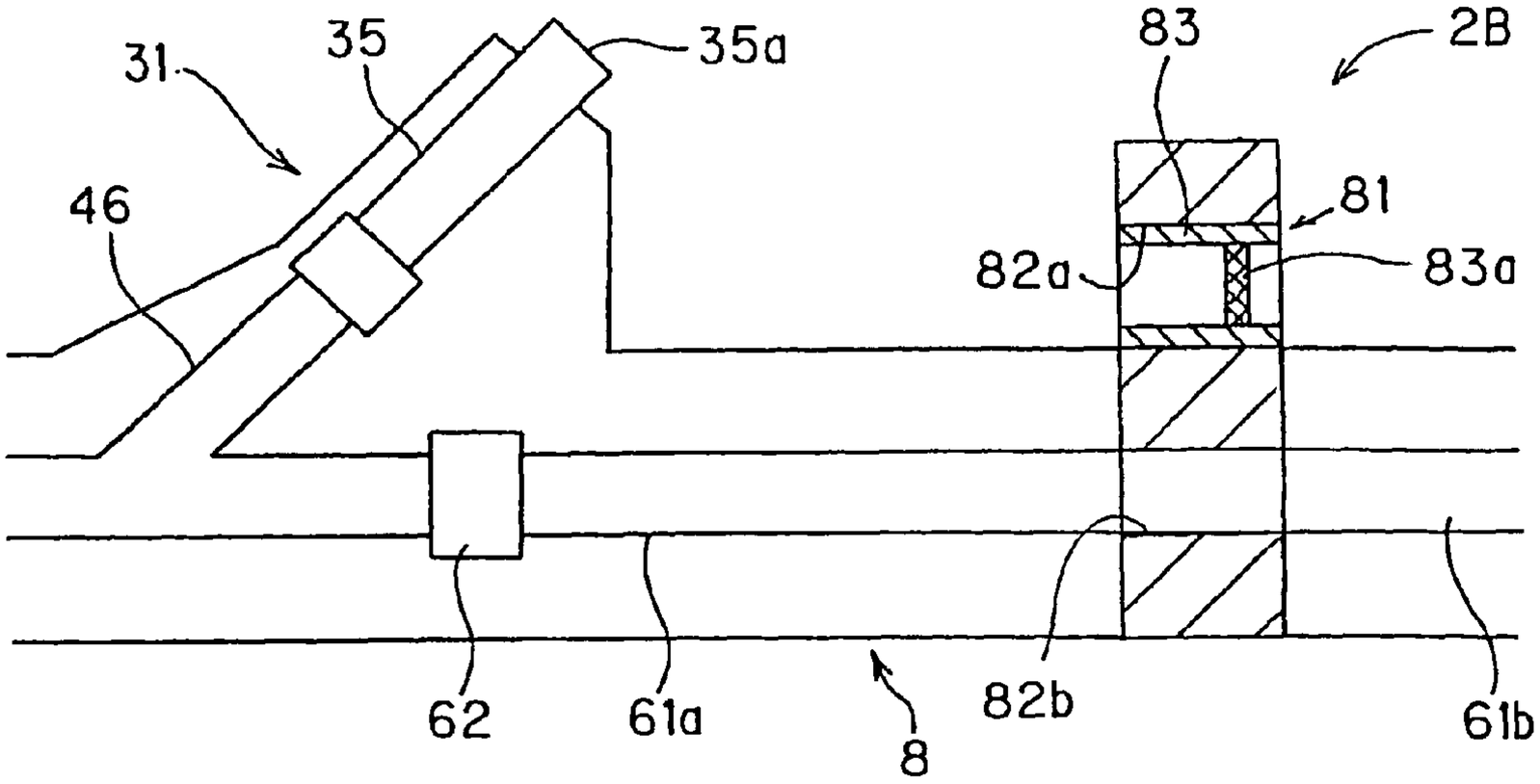


FIG.10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61b

FIG.11

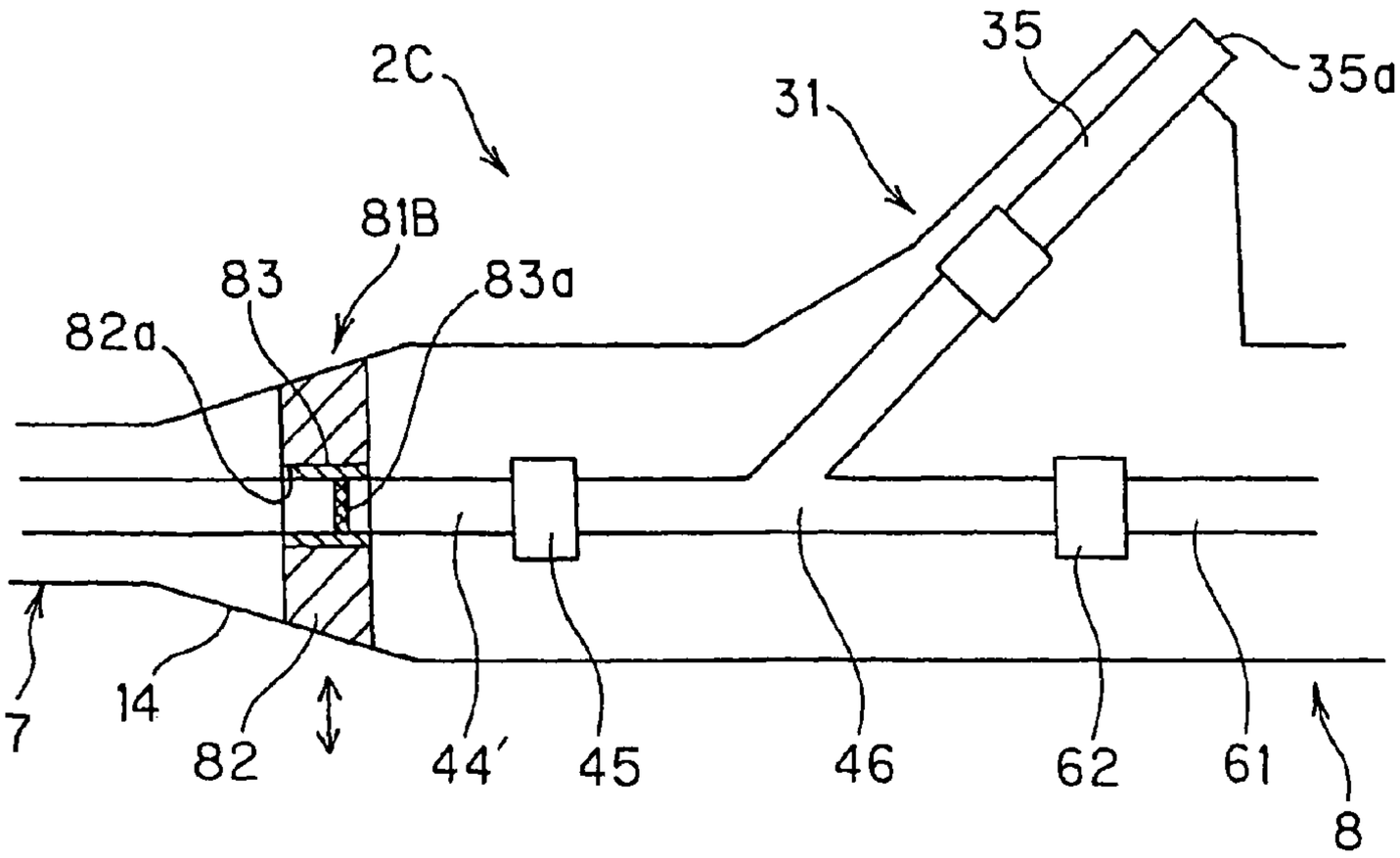
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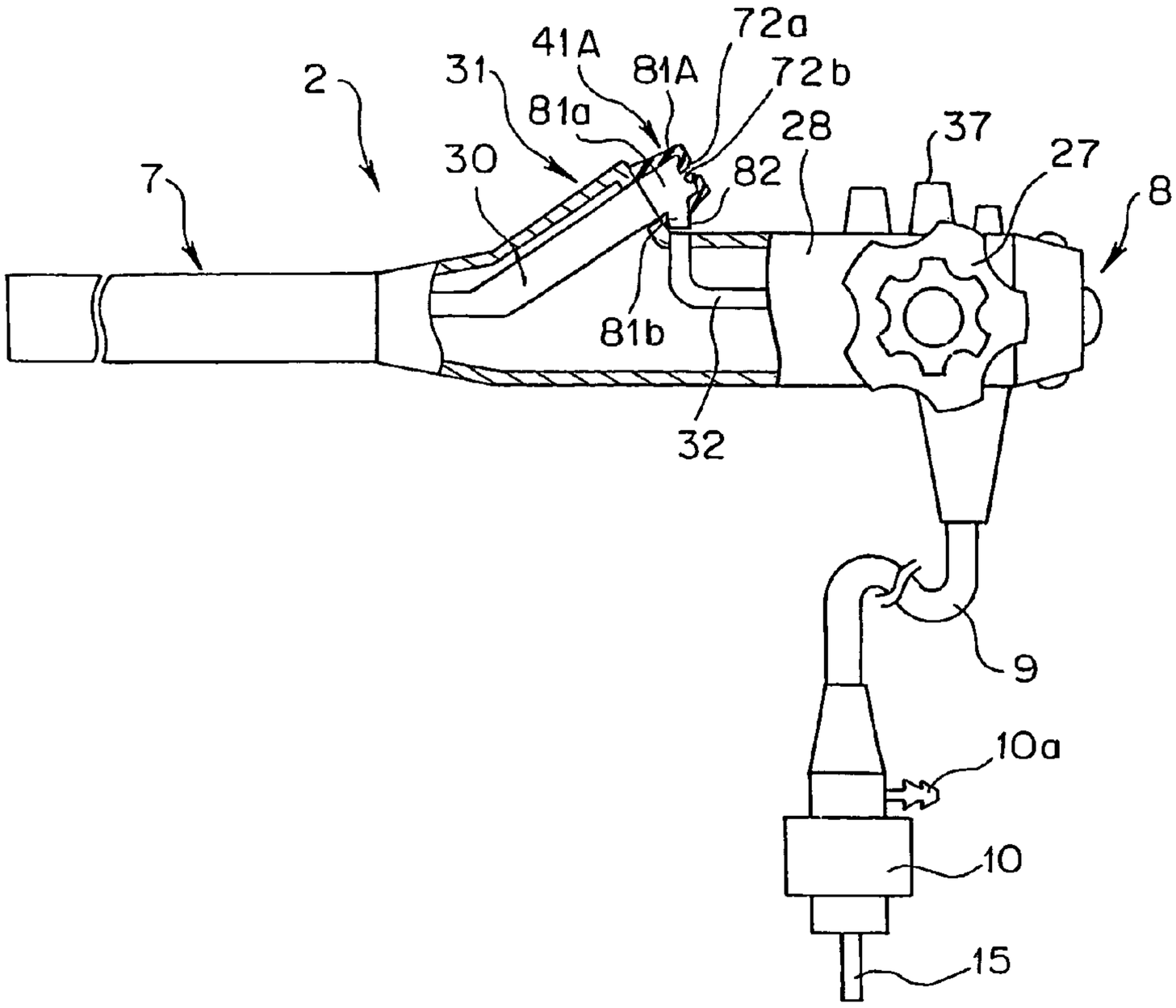
FIG.12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81b
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10a
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FIG.13

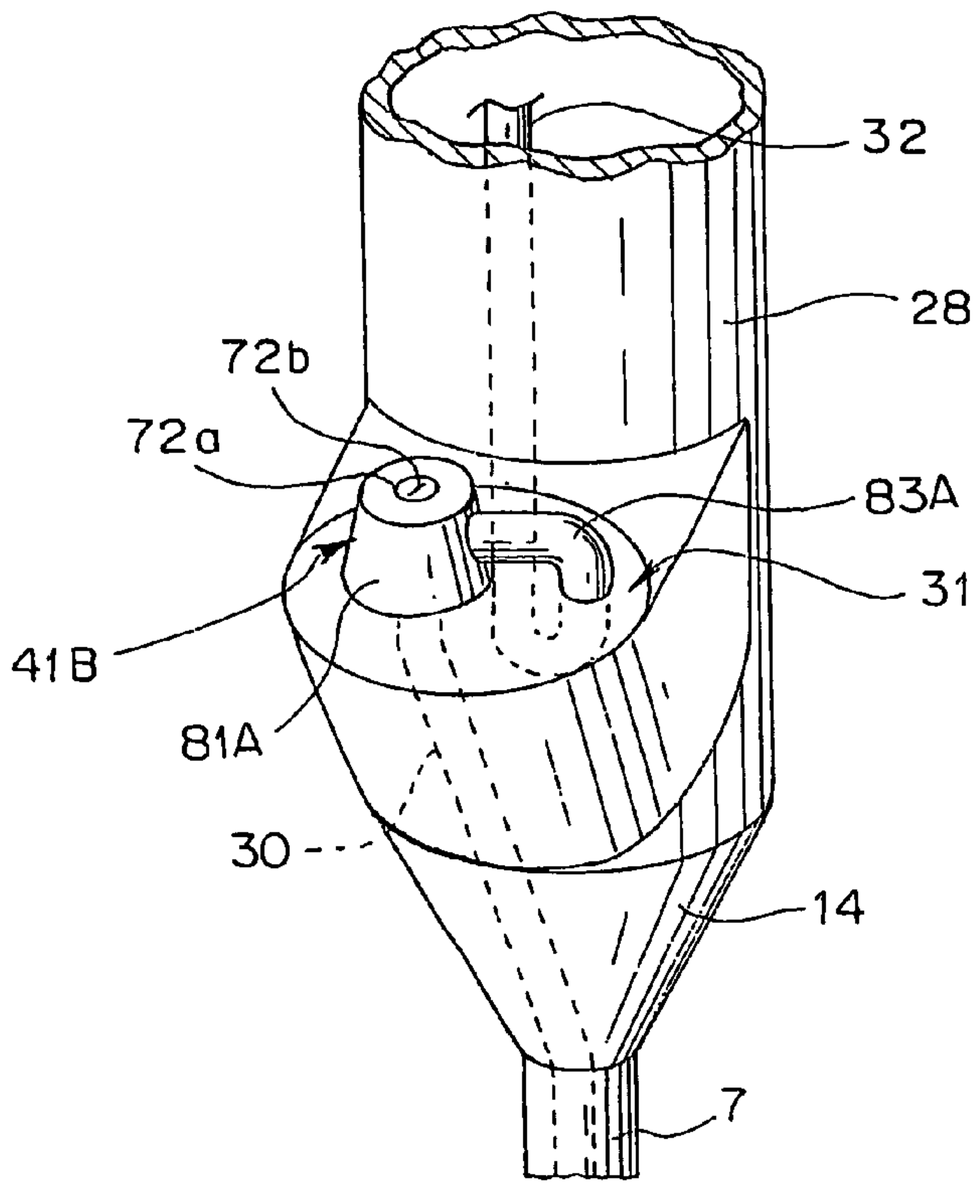
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FIG.14

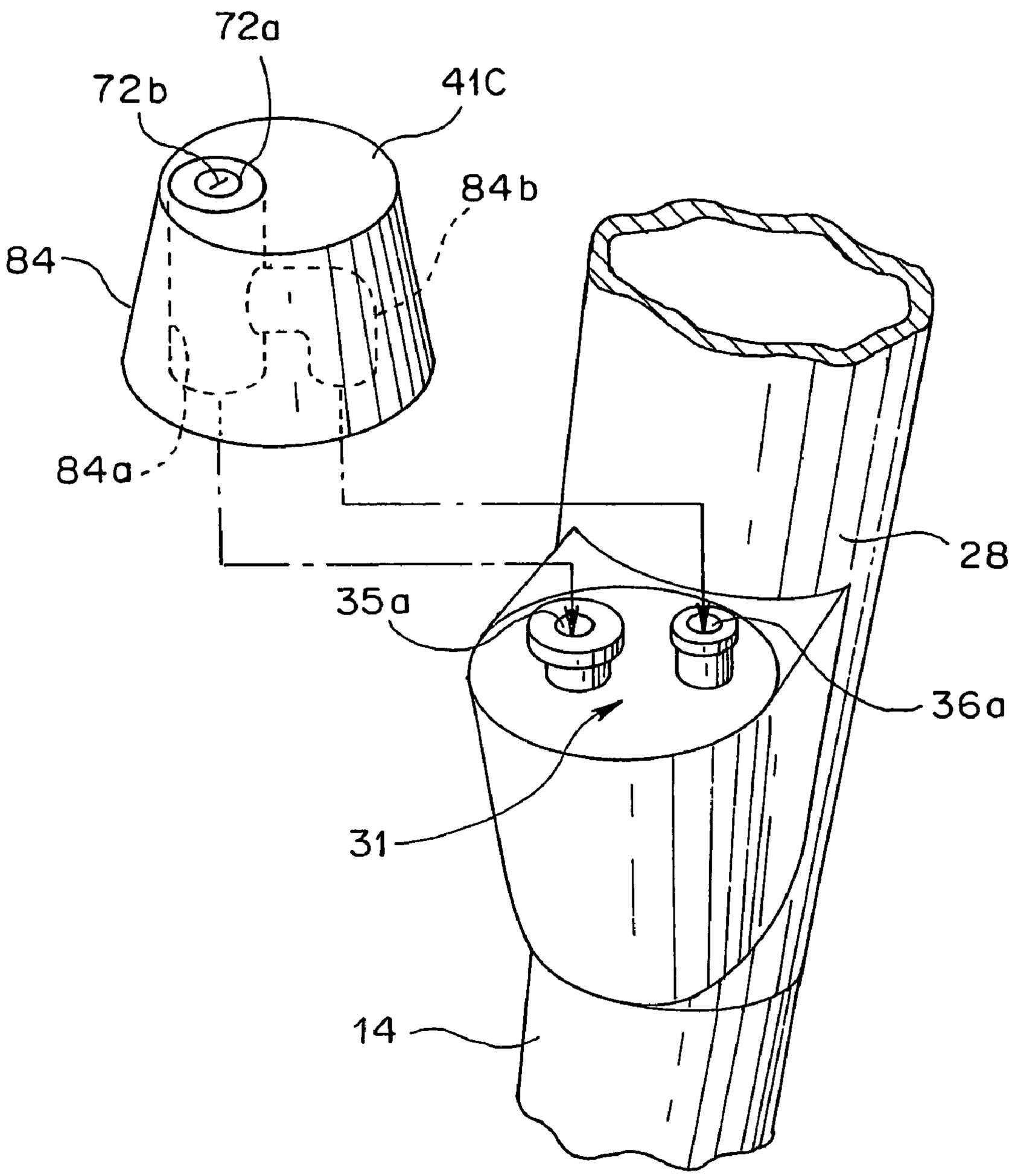
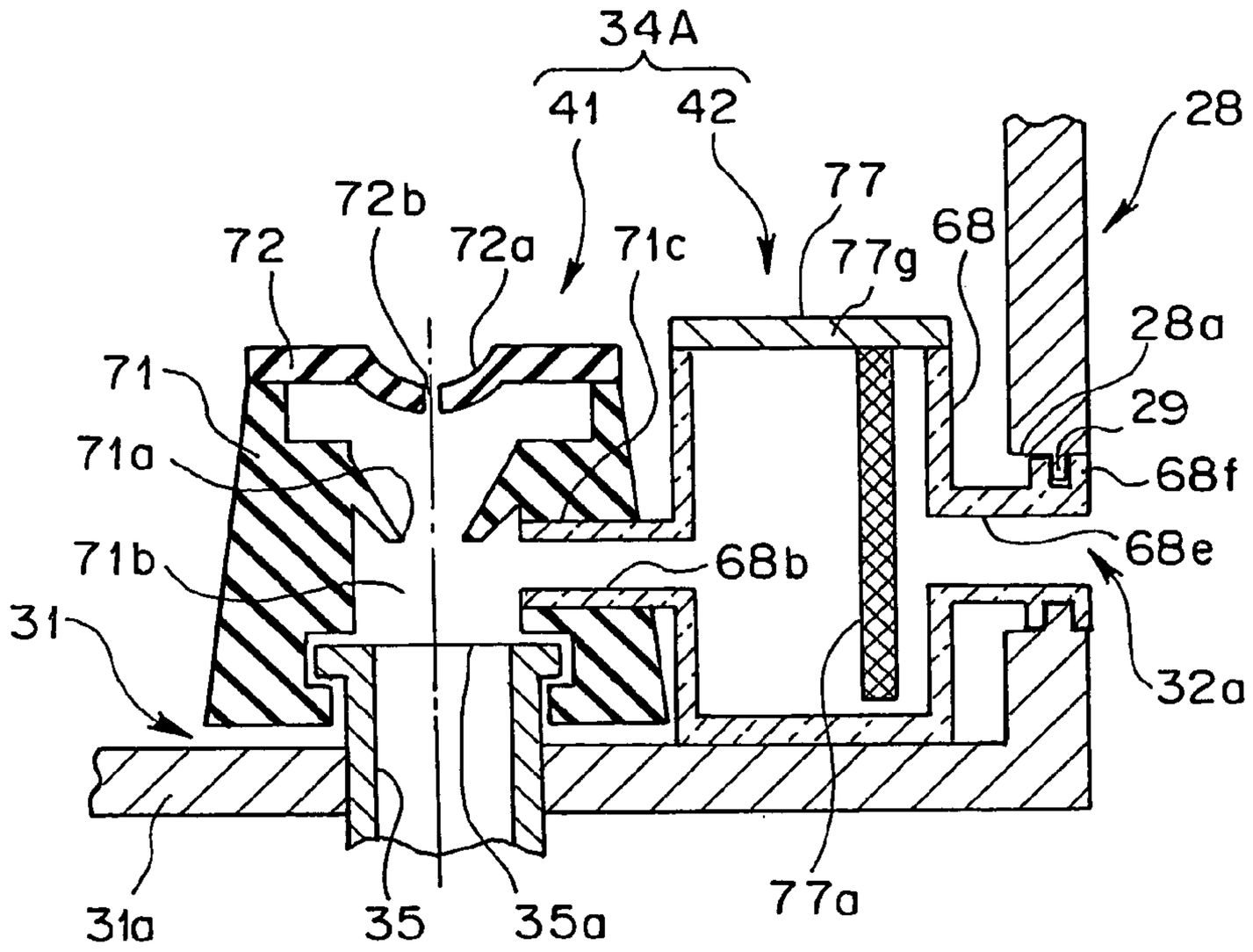


FIG.15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35a
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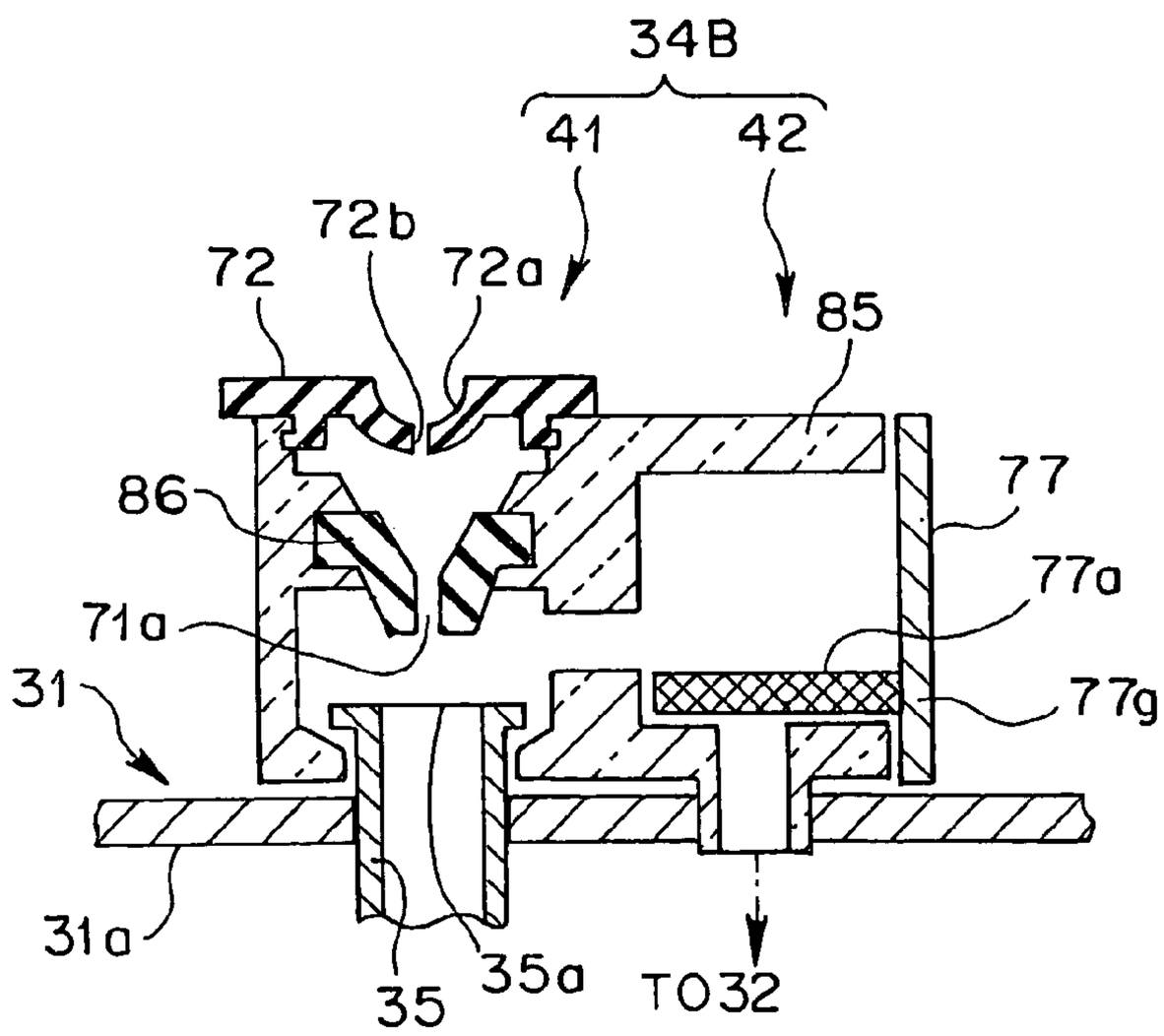
FIG.16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TO32

ENDOSCOPE WITH BUILT-IN FILTERING MEANS

CROSS REFERENCES TO RELATED APPLICATIONS

This application claims benefit of Japanese Application Nos. 2005-302182, 2005-302184 and 2005-302186 filed on Oct. 17, 2005 the contents of which are incorporated by this reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an endoscope for performing endoscopy by inserting an insertion unit into a body cavity or the like.

2. Description of the Related Art

In recent years, endoscopes have been widely employed in the medical-application field and so forth. These endoscopes can optically observe a portion to be checked by inserting an insertion unit.

In the medical-application field, endoscopes are employed for endoscopy for inserting an insertion unit into a body cavity, and optically observing a portion to be checked such as an affected portion or the like using an illumination optical system and an observation optical system provided in the tip portion of the insertion unit.

Also, in endoscopy, biopsy is sometimes performed by inserting treatment equipment within a channel duct, excising of tissue of a portion to be checked, and retrieving the excised tissue from the body as necessary.

In the event of retrieving the excised tissue from the body, a surgeon who is a doctor sometimes employs a method for removing an endoscope insertion unit from the body along with treatment equipment. However, an operation for removing and reinserting the insertion unit sometimes takes time and effort.

Accordingly, for example, the conventional example in Japanese Unexamined Patent Application Publication No. 6-54853 has disclosed an arrangement wherein a tissue-retrieving filter is disposed between a suction connector at the side toward the operator of the endoscope and a suction pump connected with this suction connector, and the tissue which has passed through a duct by suction using the suction pump is retrieved by the filter.

SUMMARY OF THE INVENTION

An endoscope according to the present invention comprises a suction duct having one end to which a suction source is connected, a suction switchover unit provided on the suction duct, and a tissue-retrieving unit disposed on an opposite side of the one end of the suction duct to which the suction source is connected, with respect to a position of the suction switchover unit.

As in the above arrangement, providing the tissue-retrieving filter portion further toward the tip side of the insertion unit of the endoscope than the suction switchover valve enables a defect due to a long duct to be eliminated, and also realizes an endoscope suitable for retrieving tissue without receiving influence of the periphery of the suction switchover valve.

According to the present invention thus described, retrieving of tissue can be performed without passing tissue through a long duct, and also without receiving influence of the periphery of the suction switchover valve.

The above and other objects, features and advantages of the invention will become more clearly understood from the following description referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an overall configuration diagram of an endoscope system including an endoscope according to a first embodiment of the present invention;

FIG. **2** is a cross-sectional view illustrating the internal configuration along treatment equipment-side collet in treatment equipment insertion portion in the endoscope according to the first embodiment;

FIG. **3** is a cross-sectional view illustrating the internal configuration along a suction-side collet in the treatment equipment insertion portion according to the first embodiment;

FIG. **4** is a diagram illustrating the periphery of a filter unit as viewed from the IV arrow visual direction in FIG. **2**;

FIG. **5** is a cross-sectional view illustrating the configuration of the periphery of the treatment equipment-side collet and the suction-side collet taken along the V-V cross-section in FIG. **2**;

FIG. **6** is a perspective view illustrating the filter unit in an assembled state with the endoscope according to the first embodiment;

FIG. **7** is a perspective view illustrating the filter unit in a disassembled state with the endoscope according to the first embodiment;

FIG. **8** is a perspective view illustrating the vicinity of the treatment equipment insertion portion with the endoscope according to the first embodiment;

FIG. **9** is a diagram illustrating the outline configuration of the periphery of an operating unit with an endoscope according to a second embodiment of the present invention;

FIG. **10** is a diagram illustrating a state in which a filter case is moved up to a position where a filter member can be removed in FIG. **9**;

FIG. **11** is a diagram illustrating the outline configuration of the periphery of a folding-prevention unit with a modification;

FIG. **12** illustrates a first configuration example of a forceps plug with an endoscope according to a third embodiment of the present invention, which is a side view including a part of cross-section of the endoscope;

FIG. **13** illustrates a second configuration example of a forceps plug with an endoscope according to the third embodiment of the present invention, which is a partial enlarged perspective view of the vicinity of the treatment equipment insertion portion of the endoscope;

FIG. **14** is a perspective view illustrating the forceps plug of a third configuration example with the endoscope according to the third embodiment of the present invention, and the vicinity of the treatment equipment insertion portion to which the forceps plug is attached;

FIG. **15** is a cross-sectional view illustrating a first configuration example of a filter unit serving as a forceps plug including a filter portion with the endoscope according to the third embodiment of the present invention; and

FIG. **16** is a cross-sectional view illustrating a second configuration example of a filter unit serving as a forceps plug including a filter portion with the endoscope according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the present invention will be described with reference to the drawings.

(First Embodiment)

A first embodiment of the present invention will be described with reference to FIGS. **1** through **7**.

As illustrated in FIG. **1**, an endoscope **1** comprises an electronic endoscope (hereinafter, abbreviated simply as "endoscope") **2** according to the first embodiment, a light source device **3** for supplying illumination light to the endoscope **2**, a signal processing device **4** for subjecting the image capturing signal to be output from the endoscope **2** to signal processing, a color monitor **5** for displaying the picture signal to be output from the signal processing device **4** on a screen, and a suction device **6** which has built in a suction pump **6***a*, as a suction source, for performing a suction operation.

The endoscope **2** comprises a slender endoscope insertion unit (hereinafter, simply referred to as an insertion unit) **7**, a thick-width operating unit **8** serially connected to the rear end side of the insertion unit **7**, and a universal cable **9** extending from the side portion of the operating unit **8**. The end portion of the universal cable **9** is provided with a connector **10**, and the connector **10** is detachably connected to the light source device **3**.

Also, the connector **10** is provided with a suction connector (suction collet) **10***a* serving as an end portion at the side toward the operator of a later-described suction-side duct **32** inserted into the universal cable **9**. The suction connector **10***a* is connected to the suction device **6** via a suction tube **6***b*.

The insertion unit **7** includes a hard tip portion **11**, a flexible bending portion **12** which is formed on the rear end of the tip portion **11**, and a long flexible portion **13** having flexibility which is formed on the rear end of the bending portion. The rear end of the flexible portion **13** is connected to the front end of the operating unit **8**. The rear end outer circumference of the flexible portion **13** is provided with a folding-prevention portion **14** in a tapered shape.

A light guide **15** having flexibility and including a fiber bundle which has a function for transmitting illumination light is inserted into the insertion unit **7**, operating unit **8**, and universal cable **9**. Upon a light guide connector protruding from the connector **10** being connected to the light source device **3**, the light guide **15** guides and transmits the illumination light from an unshown lamp within the light source device **3** up to the end face of the light guide connector.

The illumination light transmitted by the light guide **15** is emitted forward from the tip face fixed to the illumination window of the tip portion **11**, and illuminates a subject such as an affected portion or the like. An objective lens **16** attached to an observation window provided in the tip portion **11** adjacent to the illumination window forms an optical image of the illuminated subject at image-forming position thereof. At the image-forming position is a charge-coupled device (abbreviated as CCD) **17** serving as an image capturing device including a photoelectric conversion function disposed, which converts the optical image into electric signals. Note that the charge-coupling device may be a CMOS.

The CCD **17** is connected to one end of a signal cable **18**. The signal cable **18** is inserted through the insertion unit **7**, and rear end thereof is connected to the electric connector **19** of the connector **10**. The electric connector **19** is connected to the signal processing device **4** via an external cable **20**.

A drive circuit **21** is provided within the signal processing device **4**. The CCD drive signal to be output from the drive circuit **21** is applied to the CCD **17**. Upon the CCD drive signal being applied, the CCD **17** outputs the image capturing signal which is subjected to photoelectric conversion. The image capturing signal is input to a signal processing circuit **22** within the signal processing device **4**. Subsequently, the image capturing signal is subjected to signal processing by the signal processing circuit **22** to be converted into a standard picture signal. The standard picture signal is input to the color monitor **5**, and the endoscope image captured by the CCD **17** is color-displayed on an endoscope image display region **5***a*.

The bending portion **12** provided adjacent to the tip portion **11** is configured by a large number of ring-shaped bending pieces **24** being mutually connected with adjacent bending pieces **24** at vertically or horizontally corresponding positions by rivets or the like so as to move rotationally. The rear end of a bending wire **25** fixed to the bending piece **24** at the leading edge or the tip portion **11** is connected to a sprocket **26** within the operating unit **8**, and the shaft of the sprocket **26** is attached with a bending operating knob **27** for performing a bending operation (FIG. **1** illustrates the outline of a bending mechanism in the vertical or horizontal direction alone for the sake of facilitating description).

An arrangement is made wherein one of a pair of the bending wire **25** disposed in the vertical direction or in the horizontal direction is subjected to traction, and the other is subjected to relaxation, and the bending portion **12** can be bent at the bending wire **25** side subjected to traction by performing an operation for moving the bending operating knob **27** rotationally.

The operating unit **8** is provided with a gripper **28** further forward than a position where the bending operating knob **27** is provided. An arrangement is made wherein a surgeon can perform operation of the bending operating knob **27**, or the like with one hand (a finger such as the thumb or the like which is not used for gripping the gripper **28**) gripping the gripper **28**.

Also, the rear end side of treatment equipment-side duct **30** provided within the insertion unit **7** is disposed generally in parallel with the tip side of a suction-side duct **32** extending toward the forward side from the universal cable **9** side via the operating unit **8** in treatment equipment insertion portion **31** provided around the front end of the gripper **28**, and a duct separating portion **33** in which both opening ends are separated (segmentized) is formed.

The treatment equipment insertion portion **31** forming the duct separating portion **33** has detachably mounted thereupon a filter unit **34** constituting a tissue-retrieving unit including a forceps-plug function which enables treatment equipment to be inserted, and also retains the duct in an obstructive state when treatment equipment is not inserted, and a filter function of retrieving tissue.

Thus, with the endoscope **2** according to the present embodiment, the treatment equipment-side duct **30** for inserting treatment equipment is formed within the insertion unit **7**. Also, in the inside of the treatment equipment insertion portion **31** provided around the rear end of the insertion unit **7**, the treatment equipment-side duct **30** is extended to an oblique backward side, and the rear end thereof is opened as the (treatment equipment-side collet) opening portion **35***a* of the treatment equipment-side collet **35**. In the inside of the endoscope **2**, the treatment equipment-side duct **30** includes no branch portion, thereby configured so as to improve ease of insertion of treatment equipment, and the cleaning properties by insertion of a brush.

The opening portion **35***a* of the treatment equipment-side collet **35** (see FIG. **2**, FIG. **5**, and the like) is provided with treatment equipment plug (abbreviated as forceps plug portion) **41** in the filter unit **34** (see FIG. **4**, FIG. **5**, and the like), and treatment equipment is inserted from the rear end side of the forceps plug portion **41**.

Also, to the duct separating portion **33**, the tip side portion of the suction-side duct **32** extending from the operating unit **8** side is disposed generally in parallel with the rear end side

of the treatment equipment-side duct **30**. The duct separating portion **33** is adjacent to the treatment equipment-side collet **35**, and the (suction-side collet) opening portion **36***a* of the suction-side collet **36** at the tip of the duct separating portion **33** (see FIG. **3**, FIG. **5**, and so forth) is opened.

To the opening portion **36***a* of the suction-side collet **36**, a filter portion **42** for retrieving tissue serving as the tissue-retrieving portion in the filter unit **34**, and also serving as tissue-retrieving means is mounted (see FIG. **3**, FIG. **5**, and so forth).

Note that FIG. **1** illustrates the outline of the duct separating portion **33** and the filter unit **34**, and in FIG. **1**, the treatment equipment-side collet **35** and the suction-side collet **36** are adjacently illustrated within the page, but actually, they are formed adjacently in the direction perpendicular to the page in FIG. **1** (see FIGS. **5** and **6**).

Also, the side face of the operating unit **8** is provided with a suction switchover valve **37**, which is disposed on the way of the suction-side duct **32** inserted through the operating unit **8**, serving as a suction switchover unit and suction switchover means for switching a non-suction state (abbreviated as suction-OFF) and a suction state (abbreviated as suction-ON).

The suction switchover valve **37** is formed by an inner cylinder **38** being slidably disposed within a cylindrical body provided on the side face of the operating unit **8**. The opening of the bottom face in this cylindrical body is connected with the tip portion of the suction-side duct **32** extending from the universal cable **9** side connected to the suction device **6**. Also, the opening of the side face of the cylindrical body is connected with the rear end of the suction-side duct **32** extending backward from the treatment equipment insertion portion **31** side.

Also, the inner side portion of the inner cylinder **38** is connected to the suction-side duct **32** extending from the universal cable **9** side. In the event that the suction switchover valve **37** is not operated, i.e., in a suction-OFF state, the inner cylinder **38** is connected to the outside by the opening portion **38***a* provided on the side portion of the upper end side.

Accordingly, in the event that the suction switchover valve **37** is in a suction-OFF state, the suction pump **6***a* which is set to a suction running state captures the air from the opening portion **38***a*, so does not perform a suction operation through the suction-side duct **32** further toward the tip side than the suction switchover valve **37**.

The opening portion **38***a* is switched from a state connected to the outside to a state connected to the rear end of the suction-side duct **32** extending from the treatment equipment insertion portion **31** side by a surgeon performing an operation for pressing the suction switchover valve **37** against the elastic force of an unshown spring to push it into the bottom portion side of the cylindrical body.

In this state, the suction switchover valve **37** enters a state for performing a suction operation through the suction-side duct **32** further toward the tip side than the suction switchover valve **37** by the suction pump **6***a* which is set to a suction state. Thus, the suction-ON/OFF state is arranged so as to be switched by operating the suction switchover valve **37**.

Next, description will be made in detail regarding the configuration of the periphery of the treatment equipment insertion portion **31**, and the configuration of the filter unit **34** to be detachably mounted on this opening end with reference to FIGS. **2** through **7** according to the present embodiment.

FIG. **2** illustrates the internal configuration using a vertical cross-section along the treatment equipment-side collet **35** in the treatment equipment insertion portion **31**, FIG. **3** illustrates the internal configuration using a vertical cross-section along the suction-side collet **36** in the treatment equipment insertion portion **31**, FIG. **4** illustrates a part of the periphery of the filter unit **34** as viewed from the IV arrow visual direction in FIG. **2** as a cross-section, FIG. **5** illustrates the cross-sectional configuration of the periphery of the treatment equipment-side collet **35** and the suction-side collet **36** taken along the V-V cross-section in FIG. **2**, FIG. **6** illustrates the filter unit **34** in an assembled state, FIG. **7** illustrates the filter unit **34** in a disassembled state, and FIG. **8** illustrates the vicinity of the treatment equipment insertion portion **31** in the endoscope.

Note that FIG. **4** illustrates the cross-section in a state in which retrieving of tissue is set so as not to be performed, and FIG. **5** illustrates the cross-section in a state in which retrieving of tissue is set so as to be performed.

The rear end of treatment equipment insertion tube **44** is extended to the inside of the gripper **28** from the insertion unit **7** side as illustrated in FIG. **2**, and forms the treatment equipment-side duct **30** having a function for a duct (channel) into which treatment equipment is inserted, and a function for a suction duct through which tissue and the like are passed. The rear end of the treatment equipment insertion tube **44** is connected to the tip of treatment equipment-side pipe **46**, which is bent via a connection collet **45**, in a watertight and airtight manner.

The rear end side of the treatment equipment-side pipe **46** is fixed in the vicinity of an opening portion provided on the top face of a frame **48** provided within an exterior member **47** of the operating unit **8** by a fixing member **49**. The tip portion of the fixing member **49** is fixed to the frame **48** by a screw **50**, and the rear end of the treatment equipment-side pipe **46** is fitted into the cylinder portion **49***a* formed at the rear end side of the fixing member **49**, and is fixed.

Also, the cylinder portion **49***a* fixed with the rear end of the treatment equipment-side pipe **46** is connected with the tip of the treatment equipment-side collet **35** disposed in a straight-pipe shape within the exterior member **31** a of the treatment equipment insertion portion **31** via a packing **51** made of rubber in a watertight and airtight manner.

The treatment equipment-side collet **35** is disposed toward the oblique backward side from the axial direction of the insertion unit **7**. The recessed portion of the rear end outer circumference of the treatment equipment-side collet **35** is disposed with a watertight and airtight O ring **54**, and is fixed to the exterior member **31** a via a fixing resin member **52** disposed between the exterior member **31** a and the O ring **54**.

The resin member **52** is fitted into the inner face of the exterior member **31***a*, and the recessed portions of the outer circumference and the inner circumference of the resin member **52** are disposed with a watertight and airtight O ring **53**. The O ring **53** is fixed in an airtight manner by a nut **55** to be screwed into a male screw portion of the rear end outer circumferential face of the treatment equipment-side collet **35**. Note that the upper end face of the nut **55** is covered with a rubber cover **56**.

The rear end portion of the treatment equipment-side collet **35** somewhat protrudes from the end face protruding toward the oblique backward side of the exterior member **31** a of the treatment equipment insertion portion **31**, and opens at the treatment equipment-side collet opening portion **35***a* of rear end thereof. That is, the treatment equipment-side collet opening portion **35***a* constitutes the suction duct opening from which the treatment equipment is inserted.

In the upward direction perpendicular to the page in the treatment equipment-side collet **35** illustrated in FIG. **2**, the tip side of the suction-side duct **32** is provided within the

treatment equipment insertion portion **31** adjacent to the treatment equipment-side collet **35** as illustrated in FIGS. **3** and **5**.

The suction-side duct tube making up the suction-side duct **32** of the operating unit **8** side is connected to the rear end of the bent suction-side pipe **61** via a connecting collet **62** in a watertight and airtight manner.

The bent suction-side pipe **61** is also fixed by the tip of the suction-side pipe **61** being fitted into the cylinder portion **59***a* formed at the rear end side of the fixing member **59**.

Also, the cylinder portion **59***a* fixed with the tip of the suction-side pipe **61** is connected with the rear end of the suction-side collet **36** disposed within the exterior member **31** a of the treatment equipment insertion portion **31** via the packing **64** made of rubber in a watertight and airtight manner.

The tip side of the suction-side collet **36** is fixed to the exterior member **31** a via the above resin member **52**. The recessed portion provided on the outer circumferential face of the tip side portion of the suction-side collet **36** is provided with a watertight and airtight O ring **65**. Note that with the outer circumferential face of the resin member **52**, watertightness and airtightness are retained by the above O ring **54**.

The outer circumferential face of the tip side of the suction-side collet **36** is provided with a male screw portion. The suction-side collet **36** is fixed to the exterior member **31** a by screwing of the nut **66** by pressing the step portion of the resin member **52**. The upper end face of the nut **66** is covered with a rubber cover **67**.

The inner circumferential face at the tip side in the suction-side collet **36** is formed with an enlarged diameter portion wherein the diameter is enlarged in a step manner, and the enlarged diameter portion has a small-diameter cylindrical portion **68***a* of the base end of the filter case **68** in the filter unit **34** inserted and detachably mounted.

The outer circumferential face of the small-diameter cylindrical portion **68***a* is provided with a circumferential groove, and the circumferential groove stores a packing **69**.

Next, description will be made regarding the configuration of the filter unit **34**, and the configuration of the vicinity of the treatment equipment insertion portion **31** in the event of the filter unit **34** being mounted.

As illustrated in FIG. **5**, the opening portion **35***a* of the treatment equipment-side collet **35** protruding from the rear end face of the treatment equipment insertion portion **31** is detachably mounted with the mounting portion of the base end of a substantially cylindrical-shaped forceps plug main body **71** making up the forceps plug portion **41** of the filter unit **34**.

With the forceps portion main body **71**, vicinity of the rear end thereof is provided with a small-diameter opening portion **71** a which opens small, and rear end thereof has a forceps plug **72** detachably mounted.

With the forceps plug **72**, a semispherical-shaped recessed portion is provided to form a suction duct opening **72***a* for inserting treatment equipment, a notch **72***b* is provided at the center of a thin-thickness portion covering the semispherical-shaped recessed portion, usually maintains a closed-off state, and has a function such as a check valve wherein the notch **72***b* is opened by treatment equipment being inserted from the outside so as to press. The notch **72***b* is arranged to make up an opening at the operating unit side of the insertion unit side suction duct.

Also, in the vicinity of at the center of the axial direction of the cylindrical-shaped forceps plug portion main body **71** a through hole for passing through in the direction orthogonal to the axial direction is provided, a cylinder body portion **68***b* extending in the lateral direction of the filter case **68** is inserted from one of the lateral direction, and the cylinder body portion **68***b* portion is mounted within the through hole.

Note that a ring **74** connected to the forceps plug **72** is loosely fitted to the outer circumference of the cylinder body portion **68***b*, and even if the forceps plug **72** is removed from the forceps plug main body **71**, the forceps plug **72** is arranged so as to be retained in the periphery of the cylinder body portion **68***b*.

Also, a cylinder body portion **75***a* at the base end side of a duct switchover knob **75** is rotatably mounted in the through hole from the other lateral direction in a state of being fitted into the above cylinder body portion **68***b*. Note that with the duct switchover knob **75**, a rib **75***f* is formed at a position around an entrance to be fitted into the forceps plug portion main body **71**. Thus, the duct switchover knob **75** is arranged so as to be sealed in a watertight and airtight manner at the time of the duct switchover knob **75** being fitted into the forceps plug portion main body.

With the duct switchover knob **75**, a through hole is provided at a position of around the rear end of the cylinder body portion **75***a* in the direction orthogonal to axial direction thereof. In a mounting state illustrated in FIG. **5**, this through hole has the function of the treatment equipment insertion duct **75***b* for connecting between the suction duct opening **72***a* and the treatment equipment-side collet opening portion **35***a*.

Note that in the event of rotating the duct switchover knob **75** 90 degrees from the state in FIG. **5**, the treatment equipment insertion duct **75***b* using the through hole of the duct switchover knob **75** is closed off by the inner wall face of the forceps plug portion main body **71**. The treatment equipment-side collet opening portion **35***a* is in a state of closing off the suction duct opening **72***a* and a later-described filter-side duct **75***e* by the rotated duct switchover knob **75**.

In a connecting state such as illustrated in FIG. **5**, a surgeon inserts an unshown treatment equipment from the suction duct opening **72***a*, whereby the tip side of the treatment equipment can be inserted into the treatment equipment insertion tube **44** side via the treatment equipment insertion duct **75***b*, treatment equipment-side collet **35**, and treatment equipment-side pipe **46** using this through hole.

Also, in this connecting state, the treatment equipment-side collet **35** is connected to the filter-side duct **75***e* formed by the inner side of the cylinder body portion **75***a* via the treatment equipment insertion duct **75***b*, and also is connected to the suction-side collet **36** side via the inside of the filter portion **42** connected to the filter-side duct **75***e*.

To the filter case **68** of the filter portion **42**, a filter main body **77** to which a filter **77***a* is attached from rear end side opening thereof is detachably mounted so as to move rotationally. With the filter main body **77**, the filter **77***a* is integrally provided by forming a small opening in a tetragonal lattice shape (mesh shape), transmitting liquid or gas, and performing retrieving of tissue such as a polyp piece having a certain size or larger.

The filter face of the filter **77***a* is disposed in parallel with the axial direction of the cylindrical filter case **68** so as to face the filter-side opening portion **75***c* of the end portion of the filter-side duct **75***e*.

Also, with the filter **77***a*, a substantially disc-shaped bottom face **77***b* is provided on bottom portion thereof, which forms a tissue-storing chamber (tissue-retrieving chamber) **68***c* for storing tissue retrieved within the filter case **68**. Note that the filter face is provided at a position eccentric from the center axis of the cylindrical filter case **68**, and the tissue-

storing chamber **68***c* having large space is formed at a rotational moving position illustrated in FIG. **5**.

That is to say, the connecting state illustrated in FIG. **5** illustrates a state in which the filter portion **42** in the filter unit **34** is set to a rotational moving position for performing retrieving of tissue.

In this state, the capacity of the tissue-storing chamber **68***c* facing the filter-side duct **75***e* is arranged so as to be increased.

Note that the filter case **68** of the filter portion **42** is made up of a transparent member so as to visually recognize the internal filter **77***a* and the retrieved (stored) tissue from the outside, and also the filter **77***a* is also colored with a blue system color for example which can be readily distinguished from an ordinary color of body tissue.

Also, in the event of cleansing the filter case **68** in cleaning liquid or the like, a part thereof is formed as a colored portion other than a solid color, or a colored member is provided so as to visually recognize that the filter case **68** is in cleaning liquid. This coloring may be, for example, that the packing **69** provided on the outer circumferential face of the small-diameter cylindrical portion **68***a* is colored in black or the like.

With the filter main body **77**, a circumferential groove is provided on the outer circumferential face further toward the rear end side than a position where the filter **77***a* is provided, where an O ring **78** for seal is stored. Also, a filter-position switchover knob **77***c* provided at the rear end of the filter may body **77** protrudes from the opening end of the filter case **68**, which facilitates a mounting/detaching operation, and a rotational moving operation.

Note that as illustrated in FIG. **5**, in the connecting state, a slipping-prevention end portion **75***d* is formed for restricting the removal of the filter main body **77** from the filter case **68** such that a part (lower end in FIG. **5**) of the circumferential edge portion of the filter-side opening portion **75***c* of the end portion of the filter-side duct **75***e* protrudes toward the inside of the filter case **68**.

Upon the duct switchover knob **75** being rotated 90 degrees from this state, the slipping-prevention end portion **75***d* becomes a state of retreating into the cylinder body portion **68***b* from a state of protruding into the filter case **68**, which enables the filter main body **77** to be removed from the filter case **68**.

Also, with the present embodiment, an arrangement is made wherein a surgeon rotates the filter-position switchover knob **77***c* approximately 90 degrees or so from the filter position of the connecting state illustrated in FIG. **5**, and sets to a position where tissue is not retrieved as illustrated in FIG. **4**, whereby suction can be performed without passing through the filter **77***a*.

That is to say, as illustrated in FIG. **4**, upon the surgeon setting to an OFF position where tissue is not retrieved by matching the position of a triangle mark **77***f* provided on the filter main body **77** to the position of a triangle mark **68***d* provided on the filter case **68**, a (L-shaped) notch **77***d* illustrated on the substantially disc-shaped bottom face **77***b* in FIG. **7** is arranged so as to be formed at a position near the filter-side duct **75***e*.

Upon setting to a suction state, body fluid or the like sucked in via the notch **77***d* is arranged so as to be guided to the suction-side collet **36** side without passing through the filter **77***a*.

Note that with the filter main body **77**, a label indicating ON for guide to set the filter **77***a* to a retrieving position and rotational direction thereof is provided as illustrated in FIGS. **6** and **7**. Accordingly, arrangement is made wherein the surgeon moves rotationally the filter-position switchover knob **77***c* of the filter main body **77** in the direction along the label of ON up to the position where rotational movement is restricted, whereby the surgeon can set to the filter position where retrieving of tissue illustrated in FIG. **5** is performed.

Also, with the filter unit **34** in a disassembled state illustrated in FIG. **7**, following the cylinder body portion **68***b* (into which the ring **74** of the forceps plug **72** is loosely fitted) in the filter case **68** being inserted from the right side of the forceps plug portion main body **71**, and being mounted, the cylinder body portion **75***a* of the duct switchover knob **75** is inserted from the left side to be mounted on the inner side of the cylinder body portion **68***b*.

Also, the forceps plug **72** is mounted from the rear end of the forceps plug portion main body **71**. Also, the filter main body **77** is mounted on the opening portion of the rear end of the filter case **68**, which can be integrally assembled such as the filter unit **34** illustrated in FIG. **6**.

The surgeon inserts the small-diameter cylindrical portion **68***a* of the base end of the filter portion **42** in the assembled filter unit **34** so as to fit into the opening portion **36***a* of the suction-side collet **36**, and performs work for covering the opening portion **35***a* of the tip of the treatment equipment-side collet **35** with the base end of the forceps plug portion **41** by utilizing elasticity thereof, whereby the surgeon can detachably mount the filter unit **34** such as illustrated in FIG. **4**.

With the present embodiment thus configured, the filter unit **34** for retrieving tissue is detachably provided on the way of the suction duct to be used for suction at closer to the tip side than the suction switchover valve **37** of the operating unit **8** of the endoscope **2**, which is a feature of the present embodiment. Note that this suction duct is a collective term for the treatment equipment-side duct **30** and suction-side duct **32**.

That is, the filter unit **34** for retrieving tissue is detachably disposed partway on the tip side of the suction duct, which is opposite side of one end to which the suction device **6** having the suction pump **6***a* built-in, namely the other end of the suction duct, with respect to a position of the suction switchover valve. Note that the filter unit **34** is disposed further toward the one end to which the suction device **6** is connected than the treatment equipment-side opening portion **35***a* which is the suction duct opening.

Also, with the present embodiment, in the event that the filter unit **34** for retrieving tissue is mounted, and a state is set wherein tissue can be sucked in by a suction operation, the slipping-prevention end portion **75***d* of the tip of the duct switchover knob **75** forms a removal restriction mechanism for restricting that the filter main body **77** is removed.

The duct switchover knob **75** is rotated 90 degrees from this state, thereby closing off the duct further toward the tip side than the tissue-storing chamber **68***c*, specifically, the opening portion **35***a* of the rear end of the treatment equipment-side collet **35**, and also canceling the above removal restriction to form a mounting/detaching mechanism wherein the filter main body **77** can be removed, which is also a feature of the present embodiment.

That is to say, the duct switchover knob **75** is rotated 90 degrees from the state in which tissue can be retrieved by a suction operation, thereby closing off the duct further toward the tip side than the tissue-storing chamber **68***c*, specifically, the filter-side duct **75***e*. This closing-off enables the filter case **68** portion to be prevented from being opened externally (opened to the ambient atmosphere) at the time of removing the filter main body **77**. Also, even during endoscopy, this closing-off makes it unnecessary to perform work for decreasing coelomic inner pressure by performing suction before the filter main body **77** is removed, whereby mounting/detaching of the filter main body **77** can be readily performed.

Also, with the present embodiment, closer to the suction connector **10***a* side than the suction duct portion where treatment equipment is inserted, i.e., on the way of the suction-side duct **32** further toward the rear end side than the treatment equipment-side duct **30** the filter unit **34** for retrieving tissue is provided, which is also a feature of the present embodiment.

In addition, with the present embodiment, of the suction duct to be segmentized by the filter unit **34** serving as a mounting/detaching duct member, the treatment equipment-side duct (insertion-unit-side suction duct) **30** serving as the insertion-unit tip side portion, and the suction-side duct (operating-unit-side suction duct) **32** serving as the side toward the surgeon are arranged at least in the vicinity of the treatment equipment insertion portion **31** to which the filter unit **34** is mounted such that the center distance between the axis of the treatment equipment-side duct **30** and the axis of the suction-side duct **32** is gradually extending toward the filter unit **34**, which is also a feature of the present embodiment.

Specifically, as illustrated in FIG. **5**, these have an angle of θ, and are arranged such that the center distance is extending as approaching the side toward the surgeon. Further, as illustrated in FIG. **4**, the forceps plug portion **41** is provided at a position equivalent to the right side as viewed from the surgeon, and the tissue-retrieving portion is provided at a position equivalent to the left side, which is also a feature of the present embodiment. Thus, the surgeon can operate treatment equipment necessary for complex operations by the right hand without being hindered by the filter portion **42** side, thereby enabling surgeons of which right-handed persons are regarded as majority to operate treatment equipment with higher operability.

Also, as illustrated in FIG. **5**, the upper end of the filter-position switchover knob **77***c* is higher at the side toward the surgeon than the upper end of the forceps plug **72** by a height H, which is also a feature of the present embodiment. Thus, ease of mounting/detaching of the filter main body **77** can be improved. At this time, the filter-position switchover knob **77***c* is formed in a general plate shape, so that the filter main body **77** can be mounted or detached without giving influence upon the forceps plug main body **71** by the surgeon's finger.

As illustrated in FIG. **5**, the treatment equipment insertion duct **75***b* of the duct switchover knob **75** is arranged so as to become a straight line as to the duct within the treatment equipment-side collet **35** in a connecting state, and also arranged so as to become a straight line as to the notch **72***b* of the forceps plug **72**, which is also a feature of the present embodiment. Thus, the surgeon can insert or remove treatment equipment along a straight line, and can prevent damage and the like of the treatment equipment.

In addition, the duct switchover knob **75** is disposed at the branch portion between the treatment equipment-side duct **30** and the suction-side duct **32**, which is also a feature of the present embodiment. Thus, insertion and closing-off of the suction duct can be readily switched without complicating the configuration by a simple operation such as rotating the duct switchover knob **75**.

At this time, more specifically, when removing the filter main body **77**, the duct switchover knob **75** serving as a member for closing off the duct toward the suction-side collet **36** is arranged so as to be disposed in the cylinder body portion **68***b* serving as a connection duct for connecting the forceps plug **41** and the filter portion **42**. Thus, it becomes unnecessary to separately provide a member for securing closing-off at the time of removing the filter main body **77**, which enables the filter portion **42** for retrieving tissue to be reduced in size.

Further, the diameter K of the treatment equipment insertion duct **75***b* of the duct switchover knob **75** illustrated in FIGS. **5** and **7** is arranged so as to be greater than the minimum value of the diameter of the treatment equipment-side duct **30**. As for one example, the diameter K of the treatment equipment insertion duct **75***b* is greater than the diameter M of the duct portion of the treatment equipment-side pipe **46** illustrated in FIG. **5**. Thus, even if the duct switchover knob **75** is provided, the same ease of insertion/removal of treatment equipment as the conventional endoscope in which the duct switchover knob **75** is not provided can be secured.

Description will be made regarding operations of the present embodiment thus configured.

As illustrated in FIG. **1**, a surgeon mounts the filter unit **34** on the treatment equipment insertion portion **31** of the endoscope **2**, and inserts this endoscope **2** into the body cavity of a patient.

Subsequently, the surgeon enters a portion to be checked such as an affected portion or the like into an observation field of view using the image capturing means provided in the tip portion **11** of the insertion unit **7**, and sets the captured image to an observable state using the color monitor **5**.

Subsequently, in the event of desiring to retrieve tissue such as a polyp of an affected portion to perform biopsy, the surgeon inserts the tip side of an excision treatment equipment from the suction duct opening **72***a* in the filter unit **34**, and then excises the tissue such as a polyp or the like.

In the event of having retrieved the excised tissue to terminate the endoscopy, while keeping a state in which the surgeon is gripping the tissue by the treatment equipment protruding from the tip of the endoscope **2**, the surgeon should remove the endoscope **2** from the inside of the body. However, in the event of continuing the endoscopy even after retrieving the excised tissue, the surgeon removes the treatment equipment from the treatment equipment-side duct **30**.

In the event of setting a suction state by operating the suction switchover valve **37**, the surgeon sets the filter **77***a* of the filter main body **77** to a position where retrieving of tissue is performed as illustrated in FIG. **5** beforehand.

Thus, the surgeon can suck the excised tissue into the treatment equipment-side duct **30** from the tip opening in the treatment equipment-side duct **30** provided in the longitudinal direction of the insertion unit **7**.

The surgeon can store the sucked-in tissue in the tissue-storing chamber **68***c* of the filter portion **42**. In this case, the surgeon can guide body fluid or the like to the suction pump **6***a* side through a small hole of the filter **77***a*, and store this in an unshown suction-trap container or the like.

In the event of completing retrieving (storing) of the tissue into the tissue-storing chamber **68***c* by operating the suction switchover valve **37**, the surgeon rotationally moves the duct switchover knob 90 degrees from the state illustrated in FIG. **5** to set the opening portion **35***a* of the treatment equipment-side collet **35** to a closed-off state, following which performs an operation for separating the filter main body **77** from the filter case **68**. Thus, the surgeon can remove the filter main body **77** from the filter unit **34**. Subsequently, the surgeon can employ the tissue, which is adhered to the filter **77***a* of the filter main body **77** and thus retrieved, in biopsy.

In this case, according to the present embodiment, the filter **77***a* is provided in the vicinity of the treatment equipment insertion portion **31** for inserting treatment equipment, i.e., at a position further toward the tip side than the suction switchover valve **37**, so that the duct length in the event of passing tissue through the treatment equipment-side duct **30** by suction can be shortened, the possibility that the tissue may be subjected to deformation and the like at the time of passing

through the duct can be reduced, and also necessary tissue can be retrieved in a short period of time.

Also, the filter **77***a* is disposed at further toward the tip side than the suction switchover valve **37**, so that receiving influence of a narrowed portion and a bending portion in the vicinity of the suction switchover valve **37** can be eliminated. That is to say, deterioration in permeability of the tissue in the vicinity of the suction switchover valve **37** and thus taking time to retrieve the tissue can be eliminated, and also the possibility of deforming and damaging the tissue can be eliminated.

Also, with the present embodiment, the filter **77***a* portion is provided detachable from the filter main body **77** as to the endoscope **2**, and accordingly, the surgeon can easily and smoothly perform work from retrieving tissue to biopsy thereof.

Also, according to the present embodiment, the filter main body **77** having the filter **77***a* in the suction-side collet **36** adjacent to the base end side of the treatment equipment-side collet **35** for inserting treatment equipment is arranged so as to be detachable, so that the surgeon can insert treatment equipment to perform treatment using the treatment equipment even in a state of mounting the filter main body **77**.

On the other hand, in the event of performing endoscopy or the like using the endoscope **2** without retrieving of tissue, the surgeon should set the position of the triangle mark **77***f* provided on the filter-position switchover knob **77***c* of the filter main body **77** to an OFF position where tissue is not retrieved. Thus, the surgeon can discharge an aspirate sucked in such as body fluid or the like to the suction pump **6***a* side via the suction-side duct **32** and suction connector **10***a* without passing through the filter **77***a*.

Note that the above filter unit **34** can be regarded as a tissue-retrieving filter including a forceps-plug function, and also can be regarded as a forceps plug including a tissue-retrieving-filter function.

With the filter unit **34**, a part of the suction duct in the endoscope is arranged so as to be detachable (detachable duct member), which is a member including branch of the suction duct (i.e., the insertion-unit-side suction duct and operating-unit-side suction duct) to be segmentized by the filter unit **34** itself. Accordingly, the filter unit **34** is detachable, so that we can say that the detachable duct member, filter portion, and forceps plug are integrally detachable.

According to such a first embodiment, the branch between the insertion-unit-side suction duct and the operating-unit-side suction duct is provided at the forceps plug side, and accordingly, the branch of the suction duct is not provided at the endoscope main body side, whereby the cleaning properties of the endoscope main body can be improved.

The filter unit **34** including a function as a forceps plug can be separated into the forceps plug portion main body **71**, forceps plug **72**, duct switchover knob **75**, filter case **68**, and filter main body **77** as illustrated in FIG. **7**, and thus, a brush can be inserted into a duct connected to the opening portion of each part in parallel to the axis of the duct, thereby improving cleaning properties.

Also, a function as a forceps plug and a function as a tissue-retrieving filter are integrated as a filter unit, and thus, the filter unit can be integrally mounted or detached from the endoscope main body, whereby effort for mounting or detaching at the time of cleaning can be reduced.

The filter portion **42** is disposed in the vicinity of the treatment equipment insertion portion **31** which is further toward the tip side than the suction switchover valve **37**, and thus, the tissue sucked in being influenced by the narrowed portion, and the bending portion in the vicinity of the suction switchover valve **37**, can be eliminated. That is to say, deteriorating permeability of tissue in the vicinity of the suction switchover valve **37** and thus taking time to retrieve the tissue can be eliminated, and also deforming and damaging of the tissue can be eliminated.

Also, when the duct switchover knob **75** is in a suction state, the filter main body **77** is hindered from insertion or removal, and accordingly, leakage of body fluid or the like caused by the filter main body **77** being removed carelessly can be prevented. Only when the duct switchover knob **75** is in a closed-off state, the filter main body **77** can be removed, so even if the filter main body **77** is removed, the pressure within the body cavity can be prevented from deterioration.

Further, the filter case **68** is formed of a material having optical transparency, which allows a surgeon himself/herself to readily confirm at the side toward the operating unit whether or not tissue has been retrieved. At this time, the filter unit **34** is mounted on the treatment equipment insertion portion **31**, which allows the surgeon or an assistant to readily visually recognize the filter unit **34**, as illustrated in FIG. **8**. Thus, retrieving of tissue at this position can be readily performed as compared with a case of retrieving of tissue on the way of the universal cable **9**, or in the vicinity of the suction device **6**.

In addition, the suction-side duct **32** serving as an operating-unit-side suction duct is not provided in the outside of the operating unit **8** but in the inside thereof, which does not hinder the surgeon gripping the operating unit **8**.

(Second Embodiment)

Next, description will be made regarding a second embodiment of the present invention.

FIG. **9** illustrates the schematic configuration of the periphery of the operating unit in an endoscope **2**B according to the second embodiment of the present invention. The endoscope **2**B according to the present embodiment has an arrangement wherein with the endoscope **2** according to the first embodiment, a branch portion is provided in the treatment equipment-side pipe **46**, one is connected to the treatment equipment-side collet **35**, and the other is connected to the suction-side pipe **61** in a substantially direct pipe shape.

Also, the tissue-retrieving filter case **81** is arranged so as to be detachably mounted on the way of the suction-side pipe **61** further toward the tip side than the suction switchover valve **37** from the side portion of the operating unit **8**.

To the operating unit **8**, for example, a rectangular-shaped through hole crossing the suction-side pipe **61** is provided in the direction orthogonal to the axis of the operating unit **8**. This through hole stores a rectangular-shaped filter case **81** which is slidable in the depth direction. Note that the suction-side pipe **61** further toward the tip side than this through hole is represented with **61***a*, and the suction-side pipe **61** further backward than the through hole is represented with **61***b*.

To the filter case **81**, two through holes **82***a* and **82***b* are provided at an interval which is greater than the inside diameter of the suction-side pipe **61** so as to be orthogonal (transverse) to the longitudinal direction of the rectangular shape. The first through hole **82***a* stores a cylindrical filter member **83** to which a mesh-shaped filter **83***a* is detachably attached. Also, the second through hole **82***b* is arranged to be generally the same as the inside diameter of the suction-side pipe **61**. Note that the rectangular-shaped filter case **81** is made up of a member made of rubber including airtight and watertight functions.

As illustrated in FIG. **9**, an arrangement is made wherein the surgeon sets the first through hole **82***a* to a state of connecting the suction-side pipes **61***a* and **61***b*, and sets a suction

state by operating the suction switchover valve **37**, whereby the filter **83***a* hinders tissue from passing through to enable the tissue to be stored.

Also, an arrangement is made wherein the surgeon presses the lower end side of the filter case **81** from the state in FIG. **9** to move the filter case **81** to the upward side within the through hole, and sets the second through hole **82***b* to a state of connecting the suction-side pipes **61***a* and **61***b*, whereby the surgeon can remove the filter member **83** to which the filter **83***a* is attached from the filter case **81**.

Description will be made regarding operations according to the present embodiment thus configured.

In the event of retrieving tissue, the surgeon sets to the state illustrated in FIG. **9**, and operates the suction switchover valve **37** to set to a suction operating state. Thus, the tissue sucked in is hindered by meshes of the filter **83***a* from passing through to be stored in the vicinity of the filter **83***a*.

In the event of completing retrieving of a predetermined amount of tissue, the surgeon presses the lower end of the filter case **81** to move the filter case **81** to a position in the outside of the operating unit **8** where the filter member **83** can be removed. Thus, the surgeon can remove the filter member **83** from the filter case **81**. Also, in this state, the second through hole **82***b* connects the suction-side pipes **61** a and **61***b*, so the surgeon can perform an ordinary suction operation without trouble.

Also, an arrangement is made wherein while the surgeon is moving the filter case **81** from the state in FIG. **9** to the state in FIG. **10**, at least the opening end of the suction-side pipe **61** a of the tip side is not opened externally (opened to the ambient atmosphere) at a portion between the first through hole **82***a* and the second through hole **82***b* in the filter case **81**.

According to the present embodiment, even in a state in which the tissue-retrieving filter case **81** is mounted, which is mounted at a position different from a position serving as the treatment insertion entrance where a treatment equipment is inserted, insertion using treatment equipment can be performed in the same way as an existing endoscope.

Also, according to the present embodiment, retrieving of tissue can be easily performed. Also, even with the present embodiment, tissue can be retrieved without being affected by the periphery of the suction switchover valve **37**.

Further, according to the present embodiment, the present embodiment can be realized even with an existing endoscope, by modifying the configuration within the operating unit **8**.

Next, description will be made regarding modifications with reference to FIG. **11**. FIG. **11** illustrates a part of an endoscope **2**C according to a modification. In the endoscope **2**C, a filter case **81** B is detachably provided in the vicinity of the folding-prevention portion **14** which is thickened in a tapered shape in the vicinity of the rear end of the insertion unit **7**, for example. That is, the filter case **81** B is detachably provided in the vicinity of the base end of the endoscope insertion unit **7**.

That is to say, with the folding-prevention portion **14**, a though hole is provided so as to cross treatment equipment insertion tube **44'** in the direction orthogonal to longitudinal direction thereof, and the filter case **81** B is mounted slidably.

The filter case **81** B has the same configuration as the configuration of the filter case **81** according to the second embodiment wherein the second through hole **82***b* is not provided.

In the event of retrieving tissue, the surgeon should set to the state illustrated in FIG. **11** as with FIG. **9**. Also, in the event of removing the filter member **83** from the filter case **81** B, as illustrated with the arrow, upon moving the filter case **81** B to the upward side, the filter member **83** to which the filter **83***a* is attached can be removed.

In the event of not retrieving tissue, upon the filter case **81** B from which the filter member **83** is removed being set to the state illustrated in FIG. **11**, this can be used by inserting treatment equipment, or the like. Also, suction and discharge and so forth of fluid can be performed by suction.

As for the other modification, a filter member in which a filter is attached to the tip portion **11** of the insertion unit **7** may be provided, for example.

With the above-described invention, the tissue-retrieving filter portion for retrieving tissue by suction is provided on the way of the suction duct at further toward the tip side than the suction switchover valve, so in the event of performing biopsy by retrieving tissue from a portion such as a polyp or the like at the time of endoscopy, retrieving of tissue or the like can be smoothly performed.

(Third Embodiment)

Next, description will be made regarding a third embodiment with reference to FIGS. **12** through **16**.

FIG. **12** is a side view including partially the cross-section of an endoscope, which illustrates a first configuration example of a forceps plug.

As described above, the treatment equipment-side duct **30** also serves as treatment equipment insertion path for inserting treatment equipment such as forceps or the like, one end is opened at the tip of the insertion unit **7**, and the other end is opened at the operating unit (handy operating unit) **8** without branching on the way thereof. Specifically, the treatment equipment-side duct **30** is opened at the opening portion **35***a* of the treatment equipment-side collet **35**.

The suction-side duct **32**, which is disposed passing through the inside of the operating unit **8**, is configured such that one end within the operating unit **8** of the suction-side duct **32** is opened in the vicinity of the opening at the operating unit side of the treatment equipment-side duct **30**, and the other end side is connected to the suction switchover valve **37**. Specifically, the suction-side duct **32** is opened at the opening portion **36***a* of the suction-side collet **36**.

The suction-side duct **32** is bent, for example, in an L-shape so as to cross (e.g., generally orthogonal) as to the axis of the operating unit **8** in the vicinity of the opening at the operating unit side. Accordingly, with this modification, the opening at the operating unit side of the suction-side duct **32** is positioned at the side face of the tip side of the gripper **28**.

A forceps plug portion **41**A is detachably mounted on the opening at the operating unit side of the treatment equipment-side duct **30**. The forceps plug portion **41**A includes a main body **81**A made up of an elastic body, and the inside of the main body **81**A is provided with a duct **81** a configured so as to connect to the treatment equipment-side duct **30**, and a connection duct **81***b* configured so as to branch from the duct **81***a* and connect to the suction-side duct **32**.

The rear end of the duct **81***a* is provided with the suction duct opening **72***a* including the notch **72***b*. As described above, the suction duct opening **72***a* is configured so as to achieve a function as a back-flow prevention valve for preventing the air within a body cavity from leaking externally (or deflating) when the air pressure within the body cavity is higher than the external air pressure by the surgeon expanding the body cavity with air supply so as to readily observe the inside of the body cavity. Also, a part of the connection duct **81***b* is provided within the main body **81**A, and another part thereof is provided within the duct portion **82** extending from the main body **81**A.

The forceps plug portion **41**A thus configured can perform connection to the opening at the operating unit side of the

suction-side duct **32** (the opening portion **36***a* of the suction-side collet **36**), and connection to the opening at the operating unit side of the treatment equipment-side duct **30** (the opening portion **35***a* of the treatment equipment-side collet **35**) simultaneously, simply by being attached to the treatment equipment insertion portion **31**.

According to a configuration such as illustrated in this example, it is unnecessary to bend the suction-side duct **32** in a U- shape, and the curvature R of a bending portion can be made relatively great, which provides an advantage wherein ease of insertion of a brush when cleaning the inside of the duct is excellent.

FIG. **13** is a partial enlarged perspective view in the vicinity of the treatment equipment insertion portion of the endoscope, which illustrates a second configuration example of a forceps plug.

With the second configuration example, the suction-side duct **32** is bent in the vicinity of the opening at the operating unit side (the opening portion **36***a* of the suction-side collet **36**) so as to return to a U-shape at the side toward the hand side, as with the configuration example illustrated in FIG. **3**. The opening at the operating unit side of the suction-side duct **32** and the opening at the operating unit side of the treatment equipment-side duct **30** are arrayed and disposed so as to have generally the same distance as to the axis of the operating unit **8**.

Accordingly, the opening at the operating unit side of the treatment equipment-side duct **30** (the opening portion **35***a* of the treatment equipment-side collet **35**) and the opening at the operating unit side of the suction-side duct **32** (the opening portion **36***a* of the suction-side collet **36**) have the positional relation of being arrayed generally on the circumference centered on the axis of the operating unit **8**, as with the example in FIG. **3**.

The forceps plug portion **41**B is configured wherein the main body **81**A is attached to the opening at the operating unit side of the treatment equipment-side duct **30** (the opening portion **35***a* of the treatment equipment-side collet **35**), and also a substantially L-shaped connection duct **83**A to be connected to the opening at the operating unit side of the suction-side duct **32** (the opening portion **36***a* of the suction-side collet **36**) is extended from the side face of the main body **81**A. Also, the upper end portion of the main body **81**A is provided with the suction duct opening **72***a* including the notch **72***b* as described above, which is connected to the treatment equipment-side duct **30**.

According to such a configuration, the connection duct **83**A to the suction-side duct **32** of the forceps plug portion **41**B is positioned apart from the gripper **28**, so that the surgeon is not hindered by the connection duct **83**A at the time of gripping the gripper **28**. Accordingly, even a surgeon having large hands can grip the endoscope **2** with room to spare.

FIG. **14** is a perspective view illustrating the forceps plug according to the third configuration example, and the vicinity of the treatment equipment insertion portion of the endoscope to which this forceps plug is attached.

The forceps plug portion **41**C illustrated in this third configuration example is integrally configured of the duct **84***a* to be connected to the opening portion **35***a* of the treatment equipment-side collet **35** connected to the treatment equipment-side duct **30**, and the duct **84***b*, which is branched on the way of the duct **84***a*, to be connected to the opening portion **36***a* of the suction-side collet **36** connected to the suction-side duct **32**, within the main body **84**. Also, the rear end (upper end illustrated in FIG. **14**) of the duct **84***a* is provided with the suction duct opening **72***a* including the notch **72***b*.

According to such a configuration, two or more ducts to be branched are provided within one member, which provides an advantage wherein the number of parts can be reduced.

FIG. **15** is a cross-sectional view illustrating a first configuration example of a filter unit serving as a forceps plug including a filter portion.

This filter unit **34**A comprises a forceps plug portion **41** made up of an elastic body such as rubber or the like, a forceps portion main body **71**, and a forceps plug **72**, such as described above.

The forceps plug portion **41** is arranged so as to be coupled in a watertight and airtight manner by being press-fit into the opening portion **35** of the treatment equipment-side collet **35** connected to the treatment equipment-side duct **30**.

A side hole **71***c* is formed in the forceps plug portion **41** so as to become orthogonal to the treatment equipment insertion duct **71***b* within the forceps plug portion **41**, and the cylinder body portion **68***b* of the filter case **68** is inserted into this side hole **71** c.

The filter portion **42** is configured by mounting the filter main body **77** within the filter case **68** so as to be detachable. The filter case **68** of these is formed in a substantially cylinder shape with a bottom of, for example, a transparent resin or the like having translucency, the cylinder body portion **68***b* for connecting to the forceps plug portion **41** such as described above are extending from the side face, and also the duct portion **68***e* for connecting to the exterior side of the gripper **28** is extended from the other side face.

An attachment portion **68***f* is formed on the tip of the latter duct portion **68***e*, and the attachment portion **68***f* is arranged so as to be attached by being fitted into the opening portion **28***a* of the exterior of the gripper **28**. At this time, the recessed portion provided on the outer circumferential portion of the attachment portion **68***f* is attached with the O ring **29**, and thus, the filter portion **42** is coupled with the gripper **28** in a watertight and airtight manner. Thus, the filter portion **42** is connected to the opening **32***a* at the operating unit side of the suction-side duct **32**.

Note that the suction-side duct **32** of the endoscope **2** illustrated in this example is a type such as illustrated in FIG. **9**, i.e., a type wherein the opening **32***a* at the operating unit side is provided on the side face of the gripper **28**.

The filter main body **77** comprises a substantially disc-shaped lid portion **77***g* for closing the top face of the filter case **68** with a lid in a watertight and airtight manner, and a filter **77***a* formed so as to protrude into the filter case **68** from this lid portion **77***g*.

Thus, the filter **77***a* serving as a tissue-retrieving filter member is provided on the way of the connection duct made up of the cylinder body portion **68***b* and duct portion **68***e*, thereby enabling the filter unit **34**A serving as a forceps plug to be employed for both the insertion of treatment equipment, and retrieving of tissue such as a polyp which is sucked in from a subject. Moreover, the filter case **68** is arranged so as to include translucency, so that regarding whether or not tissue has been retrieved can be readily confirmed. Accordingly, time required for diagnosis can be also reduced.

FIG. **16** is a cross-sectional view illustrating a second configuration example of a filter unit serving as a forceps plug including a filter portion.

A filter unit **34**B comprises a main body **85** wherein the main body of the forceps plug portion **41** and the filter case of the filter portion **42** are integrally formed. The main body **85** is formed of, for example, a transparent resin or the like including translucency.

To the forceps plug portion **41** side of the main body **85**, a forceps plug **72** made up of an elastic member such as rubber

or the like, and an internal valve **86** made up of an elastic member such as rubber or the like so as to have a small-diameter opening portion **71** a are integrally attached.

Also, the filter portion **42** side of the main body **85** is arranged so as to be detachably attached with the filter main body **77** from the lateral side for example. Accordingly, the configuration of the filter main body **77** is basically the same as that illustrated in FIG. **16**.

Employing such a configuration wherein the main body of the forceps plug portion and the filter case of the filter portion are integrally formed enables production cost to be kept low. Also, the filter case is transparent, so that regarding whether or not tissue has been retrieved can be readily confirmed.

Note that as shown in the above respective embodiments, as for the forceps plug portion, at least a part thereof is made up of an elastic body.

Having described the preferred embodiments of the invention referring to the accompanying drawings, it should be understood that the present invention is not limited to those precise embodiments and various changes and modifications thereof could be made by one skilled in the art without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. An endoscope comprising:

an endoscope insertion unit including an observation window at a tip portion;

a suction duct having a suction source end connected to a suction source, and a suction end located on the tip portion of the endoscope insertion unit;

a suction switchover unit provided at a halfway part of the suction duct, the suction switchover unit switching over between suction ON/OFF states by the suction source; and

a tissue retrieving unit for retrieving a living tissue sucked through the suction duct, the tissue retrieving unit being located on the suction duct between the suction end and the part of the suction duct where the suction switchover unit is provided, wherein

the suction duct includes:

a first duct having one end configuring the suction end and another end configuring a suction duct opening, the first duct serving also as a duct for a treatment equipment; and

a second duct having one end configuring the suction source end and another end configuring an opening portion, and

the tissue retrieving unit includes:

a treatment equipment plug located on a suction duct opening side and capable of closing off the suction duct opening;

a filter portion for retrieving a living tissue sucked through the first duct, the filter portion being coupled to the opening portion of the second duct;

a connection duct for connecting the first duct and the filter portion;

a filter provided to the filter portion and having a mesh-shaped opening for retrieving the living tissue;

a tissue retrieving portion for retrieving the living tissue by hindering passage of the sucked living tissue by the filter;

a filter main body including the filter, the filter main body being rotatably mounted to the opening portion of the second duct; and

a switchover portion for switching over between a first state in which the living tissue passed through the connection duct is stored in the tissue retrieving portion by hindering the passage of the living tissue by the filter and a second state in which the connection duct is connected to the second duct so as to bypass the living tissue passed through the connection duct to a side of the second duct without the filter intervening between the connection duct and the second duct, depending on a rotational moving position of the filter main body.

2. The endoscope according to claim **1**, wherein the connection duct includes a treatment equipment connecting portion for connecting the suction duct opening and the suction end.

3. The endoscope according to claim **2**, wherein the connection duct includes:

a first connection hindering portion for hindering connection between the first duct and the filter portion, and a second connection hindering portion for hindering connection between the suction duct opening and the suction end.

4. The endoscope according to claim **3**, wherein the connection duct has a mechanism for simultaneously hindering the connection between the first duct and the filter portion and the connection between the suction duct opening and the suction end.

5. The endoscope according to claim **1**, wherein the connection duct has a mechanism for preventing the filter portion from being separated from the second duct.

6. The endoscope according to claim **1**, wherein the filter portion includes:

a connection portion for connecting the connection duct and the second duct without the filter intervening therebetween in the second state.

7. The endoscope according to claim **1**, wherein the filter main body is detachably mounted to the opening portion of the second duct.

8. The endoscope according to claim **7**, further comprising a switchover knob provided so as to be rotatable around an axial direction of the connection duct wherein,

the switchover knob includes a first hole at an axis portion so as to be located at a position facing the first duct in an axis direction of the switchover knob, the first through hole passing through in a direction substantially orthogonal to the axial direction of the switchover knob, and a second hole formed at the axis portion arranged in the axial direction of the connection duct, the second hole including one end connected to the first hole and another end which is open, and the switchover knob opens and closes the first duct according to a direction of the first hole which corresponds to a rotational moving position of the switchover knob, and opens and closes the connection duct in conjunction with the opening and closing of the first duct,

wherein, in a rotational moving position at which the first duct is in an open state, the switchover knob further hinders removal of the filter main body from the opening portion of the second duct by an end portion protruding from the connection duct at the axis portion to the filter portion.

9. The endoscope according to claim **1**, further comprising a switchover knob provided so as to be rotatable around an axial direction of the connection duct, wherein the switchover knob includes a first hole at an axis portion so as to be located at a position facing the first duct in an axis direction of the switchover knob, the first through hole passing through in a direction substantially orthogonal to the axial direction of the switchover knob, and a second hole formed at the axis portion arranged in the axial direction of the connection duct, the

second hole including one end connected to the first hole and another end which is open, and the switchover knob opens and closes the first duct according to a direction of the first hole which corresponds to a rotational moving position of the switchover knob, and opens and closes the connection duct in conjunction with the opening and closing of the first duct.

10. An endoscope comprising:

an endoscope insertion unit including an observation window at a tip portion;

a suction duct having a suction source end connected to a suction source, and a suction end located on the tip portion of the endoscope insertion unit;

a suction switchover unit provided at a halfway part of the suction duct, the suction switchover unit switching over between suction ON/OFF states by the suction source; and

a tissue retrieving unit for retrieving a living tissue sucked through the suction duct, the tissue retrieving unit being located on the suction duct between the suction end and the part of the suction duct where the suction switchover unit is provided, wherein

the suction duct includes:

a first duct having one end configuring the suction end and another end configuring a suction duct opening, the first duct serving also as a duct for a treatment equipment; and

a second duct having one end configuring the suction source end and another end configuring an opening portion, and

the tissue retrieving unit includes:

a treatment equipment plug located on a suction duct opening side and capable of closing off the suction duct opening;

a filter portion for retrieving a living tissue sucked through the first duct, the filter portion being coupled to the opening portion of the second duct; and

a connection duct for connecting the first duct and the filter portion, wherein the filter portion includes:

a tissue retrieving portion for, by facing the connection duct, retrieving the sucked living tissue,

a connection portion connected to the second duct, and

a filter for partitioning between the tissue retrieving unit and the connection portion, and

has a function for, by making the connection portion face the connection duct, connecting the connection duct and the second duct without the tissue retrieving portion intervening therebetween.

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